Short-term Financial Performances of VC-backed IPOs

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Dissertation

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Biographical Statement

Sandor Marton Bolla was born in Hungary (Gyor) in 1990. In 2014, he earned his B.A. in Finance and Accounting at Corvinus University of Budapest before starting his master studies at University of Porto. Additionally, Sandor has spent one academic semester at Frankfurt School of Finance & Management as an Erasmus student, which has further deepened his academic knowledge, and enriched his soft skills. During his studies in Porto and Frankfurt, Sandor has attended courses such as Corporate Finance, Corporate Valuation, International Strategy, International Finance, all of which were essential for obtaining a comprehensive understanding of finance and business. Sandor was/is particularly drawn to the challenges of venture financing and he is aiming to continue his professional career in this area.

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Abstract

Venture capital-backed initial public offerings (IPO), one of the most important exit route for venture capital firms, display similarities and differences compared to non venture-backed public listings. Hence, academic and industry interest has increased gradually in recent years, which has led to different theories in explaining IPO characteristics and performances. Using standard methodologies, we investigate the short-term stock price performance of venture capital-backed initial public offerings (IPOs) in Europe and in the US during the period 2000-2015. We analyse and compare the characteristics of venture capital-backed and other non venture-backed flotations from the above-mentioned two geographic regions. We regress initial returns and amounts of 'money left on the table' over several IPO deal characteristics. We expect that the US IPO market present clearer and easy-to-detect characteristics and relations due to its superior and well-functioning stock, and IPO market. Furthermore, it is also anticipated that findings regarding venture capital-backed IPOs partly support the certification and grandstanding hypotheses. This paper provides weak support for the former hypothesis but strong support for the latter one. We believe that by examining factors we can detect and explain performance differences across geographic regions and different types of sponsorship. Hence, it could have useful implications for external investors and for venture capitalists.

Key-words: venture capital, exits, IPO, underpricing, certification, grandstanding

JEL-Codes: G10, G11, G20, G24, G34

Resumo

Ofertas publicas iniciais (IPOs), uma das mais importantes estrategias de saída, suportadas por empresas de venture capital demostram semelhanças e diferenças quando comparadas com listagens publicas de empresas não suportadas por venture capital. Por esta razão, interesse no tema tem crescido gradualmente nos últimos anos, dando origem a diferentes teorias que explicam as diferentes caracteristicas das IPOs e a sua performance. Neste trabalho investigamos a performance da rendibilidade das ações no curto prazo de IPOs suportadas por venture capital na Europa e nos Estados Unidos durante o period de 2000-2015. Comparamos e analisamos as caracteristicas de listagens suportadas e outras não suportadas por venture capital nas regiões mencionadas. Foi feita uma regressão entre rendibilidade inicial e quantidades de "money left on the table" em diferentes caracteristicas de IPOs. A nossa expectativa é que o mercado de IPOs nos Estados Unidos apresente caracteristicas e relações mais claras e fáceis de detetar devido ao seu superior mercado de ações e IPOs. Adicionalmente, antecipamos que os resultados de IPOs suportadas por venture capital suportam parcialmente as hipoteses de "certification" e "grandstanding". Este trabalho oferece pouco suporte à primeira hipotese mas oferece forte suporte à segunda. Acreditamos que examinando fatores conseguimos detetar e explicar diferenças na performace nas diferentes regiões e nos diferentes tipos de patrocínio. Desta forma, poderá ter implicações uteis a investidores externos e venture capitalists.

Palavras chave: venture capital, IPOs, underpricing, certification, grandstanding

Classificação JEL: G10, G11, G20, G24, G34

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1 Introduction

1.1 Introduction

Asymmetric information between corporate insiders and external investors is present in capital markets when a relatively unknown firm issues securities. The ability of third-party specialists to certify value has been examined by academics in recent years, e.g. Barry, Muscarella, Peavy, and Vetsuypens (1990).

Venture capitalists (VCs) provide external source of financing for small and medium-sized firms, thus, they are intermediaries. In this paper, we scrutinize the role of venture capital backing in public listings. Venture capital-backed entities and their preferred exit routes have also been a popular topic among academics. Our interest lies in the short-term stock performance of venture-backed IPOs. The traditional approach is to compare the underpricing (UP) of venture-backed and non VC-backed IPOs and assign the difference to sponsorship, or to conduct OLS regressions using a dummy variable for sponsorship. Using this method, Bradley and Jordan (2002) find that there is no difference between the two types of IPOs after taking into account industry and underwriter quality. However, it is found that the level of UP can be influenced by using different methodologies (Gompers and Lerner, 1997).

As we stated before, we focus on the initial return (first-day) financial performance of IPOs to analyse whether these listings are underpriced. This phenomenon in finance is well-researched. Academic literature related to venture capital-backed (VC-backed) companies supports the certification and monitoring hypothesis, which state that VC-backing can be associated with higher quality (certified value) and higher value added due to closer monitoring. Barry et al. (1990) and Megginson and Weiss (1991) conduct the first research related to venture-backed IPOs. Barry et al. investigate the monitoring role of venture capital firms in public listings between 1978 and 1987. The authors find that the size of ownership, the length of board service, and the number of venture capitalists involved in transactions are inversely related to the underpricing level. They deduce that better monitoring by VCs lead to less underpricing. Megginson and Weiss compare venture capital-backed listings to non VC-backed ones and find significantly lower first-day returns of VC-backed IPOs. These findings are consistent with the view

that venture capitalists' presence works as an indication of true value and therefore less underpricing is expected.

On the other hand, the conflict of interest between VCs and portfolio companies may affect the post-IPO performance. Gompers (1996) introduce the grandstanding hypothesis which argues younger venture capital firms are less averse to take firms public prematurely than seasoned ones as a signal of ability and performance. The author argues that reputation is crucial to future fundraising. Hence VCs tend to bear the cost of underpricing because bringing a company public signals ability. Consequently, less established VCs might take portfolio companies public with higher underpricing which can have a large effect on their fundraising ability. Hence, we expect that these venture capital firms take public younger and smaller firms.

Since the birth of these papers, more and more academics seek to research the venture capital market and its specific characteristics. Other academics put emphasis on the contracting environment between entrepreneurs and venture capital firms in which financial resources are exchanged for ownership and voting rights, along with assignment of seats on the board. Lee and Wahal (2004) state that 'the receipt of venture funding is the outcome of protracted negotiations between venture capitalists and entrepreneurs.'

In this study, we choose the US and Western Europe as the geographical focuses. Investigation and comparison of these markets can add insights into to the understanding of the venture capital mechanism and the regional differences. We analyse a sample of 4,036 IPOs between 2000 and 2015, of which over 28% (1,132) are venture-backed. We observe significant clustering across both industry and geographical aspects. Consistent with the results of Lee and Wahal, the IPO market is dominated by technology-intensive industries, namely, information technology and biotechnology. Since there can be non-stationarity in our sample (Ritter and Welch, 2002), we analyse the IPOs over various sub-periods.

To analyse grandstanding we first group venture capital firms into two groups based on size of capital under management. As a next step, we undertake regressions following Gompers (1996). The endogenous variables are proxies for underpricing and few of the exogenous variables are proxies for VC reputation.

We formulate four research questions:

i. How do the short-term performances of VC-backed IPOs versus non VC-backed IPOs look like post-listing in Europe and in the US?
ii. What are the differences between the US and Europe regarding venture capital-backed IPOs?
iii. Is the certification hypothesis supported by our findings based on our European and US samples?
iv. Is the grandstanding hypothesis supported by our findings based on our European and US samples?

We find that (i) in almost all cases, venture capital-backed IPOs present higher underpricing; (ii) firm age and lock-up period reduces underpricing, especially among VC-backed IPOs; (iii) initial return and 'money left on the table' as dependent variables lead to fairly similar model characteristics; (iv) offer size has a positive relation with underpricing; (v) during hot IPO market periods, underpricing tends to be lower for both VC-backed and non VC-backed IPOs; and (vi) US venture-backed IPOs show larger underpricing.

1.2 Motivation and Aim

Nowadays, one can meet with private equity funds on the streets, in the shopping malls or even on the internet. There are thousands of firms backed by private equity funds all around us. Indeed, the private equity asset class, which includes venture capital, has become a substantial part of the economies in both the US and in Europe. For example, the capital raised by the global private equity industry amounted $527 billion in 2015 and increased by 12 percent on average in the last five years (Bain & Company, 2016). Therefore, private equity funds and their activity could not avoid being subject of heavy debates. Academic and practitioner scrutiny has gradually increased in the last decade, and regulators have paid more attention to this immensely growing asset class.

In our dissertation, we put the venture capital-backed IPO performances in the spotlight during the time period 2000-2015. Buyout and venture capital funds belong to the same asset class, but they differ in several ways. In this paper, we focus on venture capital-backed firms. We consider buyout funds to have different characteristics, and analysing

this segment of private equity market would require a larger research than contained in a master thesis.

The aim of this study is not to answer whether venture capital firms should or should not choose initial public offering as a compelling exit route, we simply show what the differences in these two markets (Europe and the US) are. Additionally, we might be able to detect factors that influence the difference in stock market performances. Analysing the performance of venture-backed companies may offer new insights into the value added by venture capitalists. The academic literature provides a comprehensive analysis of this topic, yet the findings are inconclusive. Although there are many existing studies about this topic, we believe that by using up-to-date data, this study can contribute further to existing literature. Our findings intend to contribute to the improvement of the European venture capital market.

With this study, we will be able to obtain a comprehensive overview over IPOs as an exit route for venture capitalists and to get a better understanding of the characteristics of venture capital backing in the US and Europe.

The remainder of the paper is organised into sections as followed. Section 3 introduces the topic and provides short insight into how venture capital works. Additionally, the literature review of the topic shows and intorduces the most relevant academic papers about venture capital-backed IPOs and their characteristics. Section 4 presents our hypotheses. In Section 5, we present our data and research methodology. Afterwards, in Section 6, the results and findings of our econometric calculations are described in detail. At the end of this work, in Section 7, the summary of the findings of the research and our conclusion can be found.

2 Literature Review

The literature review, on the role of venture capital in IPO process, provides a detailed overview of venture capital related IPO characteristics, and performances. Although large amounts of academic papers about the aforementioned topic were found, clearly, the findings are not conclusive due to different time periods, geography, or methods.

2.1 Introduction into the Asset Class Venture Capital

2.1.1 The Origin of Venture Capital

Landström (2007) regards venture capital as an activity that has roots from ancient times. He argues that mankind has always had a tendency or need to invest in projects with high-risk profile. As an extraordinary example, we can mention the venture of Christopher Columbus financed by Queen Isabella of Spain. Another example is the investment activity of private individuals during the industrial revolution in the 19th and early 20th century. According to the author, the Boston area was perhaps the root of the modern, organised venture capital market, which provided the first US venture capital firm, called American Research and Development Corporation founded in 1946. The Silicon Valley, a region where a dense cluster of technology-based enterprises can be found, began to rise in the early 1960s.

The academic interest in venture capital can be dated back to the 1970s. Afterwards it expanded substantially in the following decades. Since the US venture market is the most dynamic venture capital market, the interest was especially strong among researchers in the US.

2.1.2 What Is Entrepreneurship?

The term has French origins, and its literal translation is "undertaker". According to Schumpeter (1934), the entrepreneur is the person who is actively searching for opportunities to innovate. Consequently, entrepreneurship contributes to economic development, since it permanently challenges the status quo of the market by delivering profits from risky projects and by combining resources in unusual ways.

Nowadays, entrepreneurship can be described as a multistep process. First, the entrepreneur recognises an opportunity to create value by combining resources. Second,

the entrepreneur plans a strategy to gain control over the necessary resources. Third, the plan is implemented and carried out to realize the venture. Finally, entrepreneurs harvest their successful ventures (Smith and Smith, 2007).

2.1.3 The Definition of Venture Capital

Isaksson (2006) defines venture capital as private investments made in ventures that are not quoted on a stock market, and they are likely to grow significantly and become notable players internationally.

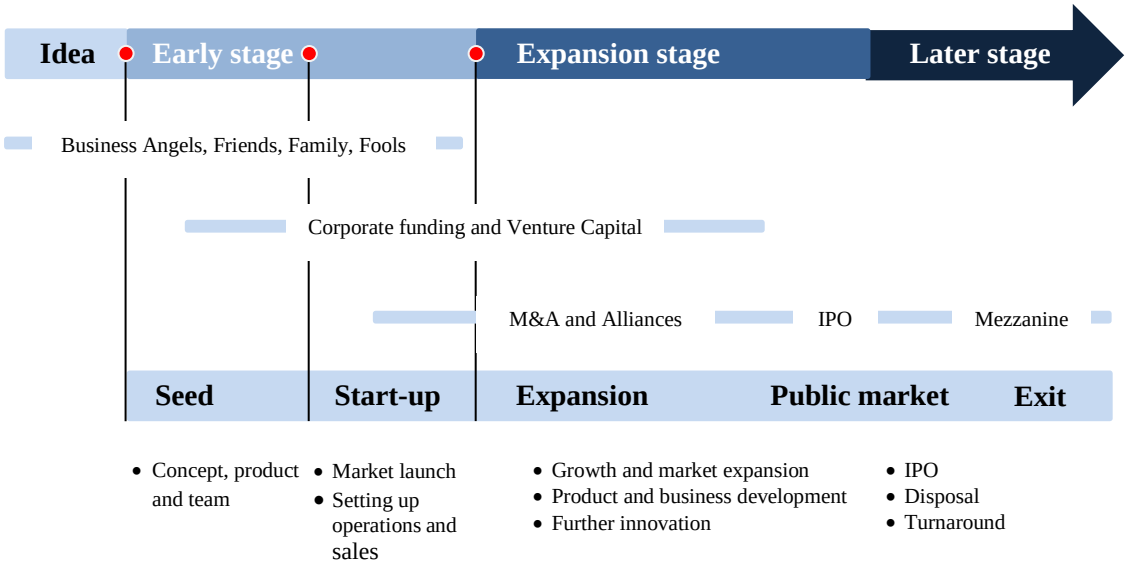
Andersen (2015) defines private equity as 'investments that range from investments in unlisted (i.e. private) companies in return for shares or other ownership interests (i.e. equity) in such companies.' Normally, private equity comprises investments in firms at all stages of development, which can range from start-ups to mature businesses. We have to highlight that the term 'private equity' in the US refers to investments in more mature companies, while 'venture capital' can be seen as investments in businesses at their early stage. According to Gompers (1993), private equity investments can be divided into four different subclasses such as venture, mezzanine, buyout, and distress capital. In the spotlight of this research paper stands venture capital. Moreover, we regard the term 'private equity' as the asset class that contains as a subclass e.g. venture or buyout capital. Andersen (2015) regards 'venture capital' as 'capital invested in return for shares in unlisted companies in the early stages of their development. Such investments are made with a view to making a profit on the subsequent sale of the shares. Venture capital investors are willing to accept a relatively high risk, but on the other hand they expect a high return.' In sum, the target of venture capital funds are young, innovative and fast-growing companies with the potential to become significant players in the given market. Normally, these ventures are in need of capital that is far larger than their own sources and they are not able to attract this capital from other sources.

To sum it up, VCs are specialised in the financing of innovative ventures and play an intermediary role minimizing asymmetric information and providing financial and non-financial resources to generate added value and high returns.

According to Gompers (1993) the subcategories of venture capital are as follows:

- seed/start-up financing
- early stage financing
- expansion/growth financing
- later stage financing

Figure 1: Start Up Financing and Development Cycle

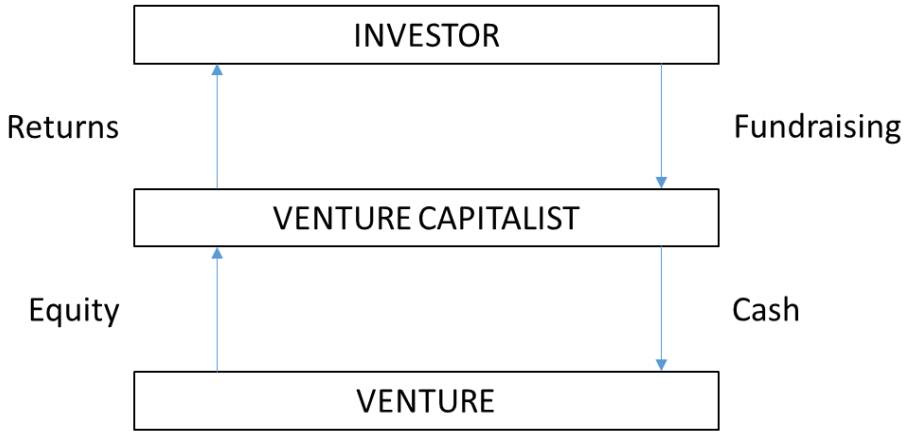


Source. Smith and Smith (2000)

Furthermore, the three main submarkets of venture capital are institutional venture capital, corporate venture capital, and informal venture capital. In this study, we focus mainly on institutional venture capital (also called 'formal venture capital'). According to Mason and Harrison (1999), 'the institutional VC industry comprises of full-time professionals who raise finance from pension funds, insurance companies, banks and other financial institutions to invest in entrepreneurial ventures.

Andersen (2015) states that PE funds are characterised by their life-cycle, where, within a time period of 10 to 12 years, the management of the fund receives capital from external investors, which is invested in portfolio companies and finally exits the investments at a profit and returns part of it to the external investors.

Figure 2: Players of the Private Equity Industry



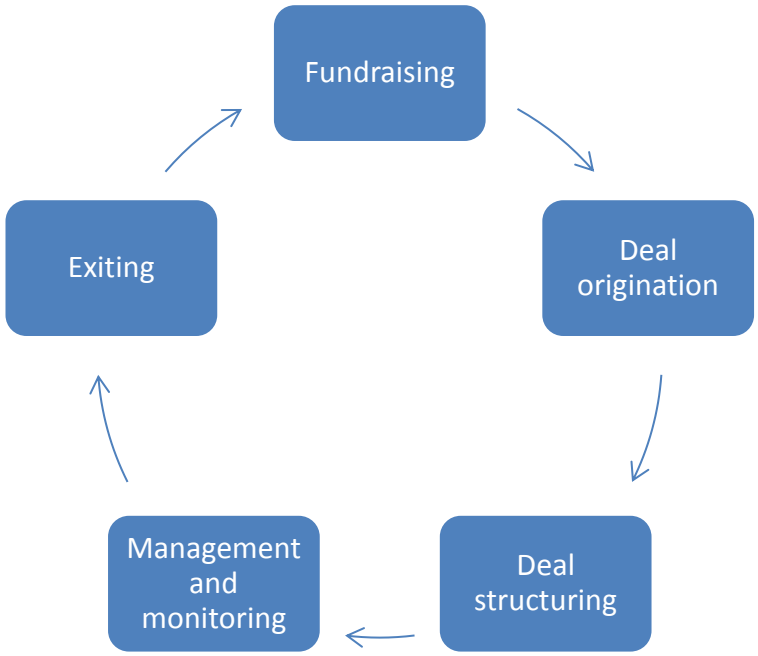
Source. Andersen (2015)

PE funds are normally run in the form of a limited partnership due to tradition and different law and tax advantages. External investors consist of institutions, firms and wealthy individuals. In a limited partnership, PE funds are general partners who control the fund's activities, whereas the external investors are limited partners who does not play any role in the day-to-day management of the fund. PE fund, thus, act as financial intermediaries between external investors and private companies (Gompers, 1993).

Venture capital firms act as active and temporary partner of the portfolio companies. While buyout funds usually take majority stakes in companies, VC funds normally prefer minority stakes. Venture capitalists benefit only from the profit reached by successful exits. Carried interest is paid to the venture capital firm if they are able to pay back the invested capital plus an annual internal rate of return. This is the reason fund managers tend to sell their stakes in portfolio companies as soon as they do not see any more potential to increase the value of the company.

The detailed private equity life-cycle consists of several stages:

Figure 3: Private Equity Life Cycle



Source. Smith and Smith (2000)

2.1.4 The Development of Venture Capital Industry in the US

The venture capital industry grew slowly and it was fragmented and geographically concentrated. Between 1946 and 1977 the money that flowed into the venture capital market have never overstepped a few hundred million dollars annually. At the end of the 1970s, the venture capital could be described as 'very small, homogeneous and weak in competition'. However, in the early 1980s, the venture capital industry rose enormously. This dramatic increase was triggered by the rise of investment opportunities and the introduction of tax-related incentives. After the end of the 1980s, the market consisted of almost 700 firms and a pool of more than $30 billion in 1989. The 1990s was driven by the new opportunities on the IPO market and the exit of many venture capitalists. In 2000, before the *dot.com* crash, the total money flow into venture capital reached an enormous $102 billion, and the average investment size was about $18 million. The bursting of the Internet bubble had an enormous effect on the venture capital market. The whole market,

both the number of venture capital firms and capital invested dropped immensely and substantially affected the behaviour of venture capitalists. (Landström, 2007)

For the US venture capital market also took a few years to recover after the financial crisis. However, after the steep decrease in investment in 2012, venture capital investment activity recovered in 2013. High-level figures, successful fund closings, improving economic environment, and the rapidly improving exit conditions opened the way for the following years. An open IPO window hallmarked the recent years accompanied by advanced mobile technology which led to significant changes in various sectors. This implies that information technology continues to be the sector that dominates the venture capital market in the US. Globally, the US economy account for 68% of global venture capital activity which makes US the largest hotbed of the VC industry. Europe accounts for only 15% of global VC activity (Ernst &Young, 2014).

2.1.5 The Development of Venture Capital in Europe

According to Landström (2007), the intensive emergence of venture capital in Europe happened in the late 1970s. However, these companies were rather initiatives and organised venture capital was non-existing during that time. During the late 1980s a more significant venture capital market emerged driven mainly by the introduction of secondary stock markets in many countries. According to the author, the European market as a whole is not that much smaller than the US market. However, there are several similarities, but also many important differences, between the two markets. Meanwhile the US venture capital industry is considered as a sufficient source of capital for high growth ventures, in Europe the venture capitalists still has to prove their existence.

Kaplan, Martel, and Stromberg (2007) and Hege, Palomino, and Schweinbacher (2005) reached the same result. There is a widely held perception that Europe is lagging behind the US in most dimensions with respect to the venture capital market. They show a significant underperformance of European venture capital. After the economic crisis the European venture capital market stabilised itself and in 2013 demonstrated high growth. The UK, Germany, France, and the Scandinavian countries are the dominant hotbeds of the region. 2013 also brought a shift in the European venture capital investment pattern. VC funds increased their participation in the early-stage ventures. More than a quarter (27%) of financing rounds were undertaken by business angels or incubators.

2.1.6 The Capital Market Based Financial System as the Foundation of VC

According to Gilson and Black (1999), the United States has small banks that play a limited role in the governance of large corporations, and a well-developed stock market with frequent IPOs. In contrast, the European large banks play a larger role in monitoring firms. The US has a larger number of VC funds and the funds themselves are larger relative to Europe. In addition, US funds invest heavily in early-stage ventures and high-technology industries, while European venture capital provides primarily later-stage financing in lower-technology industries. The authors argued that venture capital can flourish only if the venture capitalists can exit from a successful portfolio company through IPOs, which requires an active stock market. According to the authors, other countries failed to replicate the U.S. venture capital market because only a well-developed stock market permits venture capitalists to exit through an IPO. Moreover, the potential for exit through an IPO allows the VC and the entrepreneur to agree over control rights that is not easily duplicable in a bank-centered capital market.

Booth, Junttila, Kallunki, Rahiala, and Sahlström (2006) find evidence that capital market-based financial systems are better in favour of the venture capital market than bank-based financial systems. Rajan and Zingales (2003) introduces the lack of transparency and high information asymmetries as main barriers of the venture capital market in bank-based financial systems.

On the other hand, Axelson and Martinovic (2015) showed that for both Europe and the US probability of exit via IPO has gone down significantly and the time to IPO has gone up over the last decade. The authors argued that there is no difference in the likelihood or profitability of IPOs between European and US deals. They found the same success factors for both regions, mainly, experience and serial entrepreneurship.

2.1.7 The Importance of Venture Capital

Having introduced the development of venture capital, we highlight the importance of this asset class. Landström (2007) argues that in our modern world countries' competitiveness is driven by their capability to innovate. In our ever-changing world large and established companies are not producing that much of innovation and jobs. In addition, the source of new technologies are companies that emerged in the last 20 years.

Policy makers in the US realised a long time ago that sustainable economic growth and creation of jobs can be reached only by flourishing entrepreneurship. In the recent years, all over the globe governments try to create policies and the right funding ecosystem, which can support directly or indirectly the venture capital industry and entrepreneurship. According to a research report, Ernst & Young (2013), the second most important funding source after bank credit are public aid and government funding programs. As a consequence, the society needs growth-oriented entrepreneurial ventures with knowledge-based and technological driven ideas.

Smith and Smith (2000) argue that these ventures almost in all cases face the problem of raising capital for growth and gaining access to competence, experience, networks, and other resources that are sufficient for growth. This is the reason a healthy venture capital market is inevitable for growth-oriented ventures. They can provide capital, management skills, and other skills which entrepreneurs lack of. It is assumed that the high level of the US venture capital market is one reason for the ability of the US economy to make high growth companies out of innovative ideas from universities and R&D arms. Google, Facebook, Intel, Microsoft, and Amazon.com can be mentioned as good examples. Bygrave and Timmons (1992) argue that the US venture capital market is perceived as the 'gold standard' of early-stage innovation finance system.

Gompers and Lerner (1999) and Da Rin et al. (2006) regard venture capital as a significant vehicle for promoting successful new firms and the economy as a whole. Furthermore, the effect of venture capital activities has been found significantly positive on employment (Wasmer and Weil, 2000).

2.1.8 Venture Capital and Value Added

Venture capital funds seek to time fundraisings according to the arising investment opportunities and later they have to make good decisions about follow-on investments by continuously monitoring, advising, and assessing the portfolio companies. Finally, they seek to harvest their investments by choosing the best available exit route. Although evidence from studies suggests that VC involvement add value, it is unclear whether the benefits derive from their involvement or from their ability to select companies in which to invest.

Smith and Smith (2000) state that the ideal portfolio companies to venture capital funds are those in which venture capitalists can add significant value. Thus, venture capitalists usually specialise in certain industries, and they focus on different stage of development in different geographic area. Additionally, market conditions affect the dynamics of the industry, therefore, it can influence the activities and performance of funds.

Venture capitalists may add value by selecting and monitoring portfolio companies or by providing advisory services to them. However, findings are mixed related to this statement.

Gompers and Lerner (1999) state that venture capitalist are able to mitigate information asymmetries between investors and entrepreneurs. Additionally, close monitoring and motivation of management by VCs result in more success stories. Activities of venture capital firms may reduce volatility in returns through diversification and information problems by taking board seats and special rights.

However, Barney, Busenitz, Fiet, and Moesel (1996) document that portfolio companies do not perceive much value added by being advised. In contrast, evidence has been found that venture capitalists promote innovation. In most of the cases venture capital involvement is associated with higher levels of patents.

Venture capital can serve as certification factor in the IPO process since VC backing is associated with lower underpricing of IPOs and with lower total cost of going public. The topics underpricing and certification hypothesis is introduced and discussed extensively in the next sub-chapters.

2.2 Exiting

Andersen (2015) argues that private equity funds usually have a finite life-time of 10 years in which they must find investment opportunities, carry out deals, monitor and create value add and exit their investments. The term "exit" refers to the divestment activity of portfolio companies which is the last stage in the venture capital life-cycle. Cumming (2010) argues as well that venture capitalists exit from their investments when the expected value added by another financing rounds is smaller than the costs. Factors that influence the exit decision of venture capitalists can be profitability, contractual arrangements and exit terms, actual market environment exit alternatives, and alternative

investment opportunities. The author argues that exit alternatives are a good indicator of the attractiveness and the development of the venture capital industry.

Due to the special business model of private equity funds, general partners have to set up new funds once the previous one is about to be closed. One does not have to mention that only fund managers with sound track records are able to successfully raise subsequent funds. Logically, exits are probably the most important activity in the venture capital life-cycle.

Jenkinson and Sousa (2013) argue as well that the timing and the choice of a good exit strategy influence not only the return of the investment but has also an effect on investor's track record, thus, on subsequent fund raising activities.

Gompers and Lerner (2006) state as well that successful exits are critical for both ensuring high returns and raising capital. Put it another way, exiting is the crucial point of the cycle. As a good example can be mentioned the secondary markets developed by many European countries in the early '80s. After the 1987 market crash, IPO activity dropped rapidly and the European markets could not recover which left VCs without the option to take portfolio companies public and the market remained depressed. In the US, however, the IPO market recovered and VCs were able to raise new capital.

2.2.1 Problems of Exiting

Venture capitalists' behaviour during the exiting process can sometimes bring about severe problems for entrepreneurs. As stated before, since venture capitalists are rewarded purely on exit proceedings, they seek to exit in the most profitable and fastest way. Additionally, exit results signal the quality of the venture capital firms. Thus, VCs might encourage portfolio firms to undertake actions that can support the success of a possible IPO regardless of the long-term effects of them. For instance, VCs might encourage management to cut vital research spending in order to increase earnings. (Smith and Smith, 2000)

Additionally, VCs might take advantages of insider information and they might exit their investments, causing harm to other shareholders. (Smith and Smith, 2000)

Additionally, venture capitalists face not only the risk stemming from the founder's attempt to develop a marketable product, but liquidity risk as well. It occurs when a venture capital firm is not able to exit its investment at all, or not at its fair market value. Another issue is the equal opportunities to exit investments. Interest in certain technologies by public investors appears to be concentrated. For example, public market focus has changed a lot in the recent past, from computer hardware, multimedia, to biotechnology and internet companies. Consequently, this phenomenon can lead VCs to invest more into ventures from hot industries. Hence, promising but not in the spotlight standing industries might attract insufficient capital. (Smith and Smith, 2000)

Schwienbacher (2007) makes the academic knowledge more complex by analysing the relationship between the level of innovation and exit strategies of venture capitalists. The author finds that more innovative and profitable ventures are they are more likely to go public than ventures with more imitative products or services. In addition, it has been documented that IPO exit route is more preferable to founders. Hence, entrepreneurs will favour more innovative R&D project which can influence products and services of ventures. In addition, the author argues that exit decisions of VCs have two dimensions, namely, the type of the exit route and the timing of the chosen exit route of which both can affect the success of the venture capitalist and the entrepreneur. Schwienbacher (2009) argues that venture capitalists take firms public in order to raise additional capital, and thus, to make themselves possible to successfully exit their investments. Therefore, stock market conditions are extremely important for them since their ability to time IPO exits are limited Schwienbacher (2009).

2.2.2 The Importance of Financial Contract Design

Financial contract design is a key mechanism in venture capital investments which can efficiently provide financing and, at the same time, reduce adverse selection and moral hazard issues. The ideal contract design provides an option-like payoff plan which is a desired risk-return profile for venture capital firms. Convertible securities meet perfectly the aforementioned requirements which offer protection against downside risk and secure substantial gains in case of an upside scenario. (Cumming, 2005)

According to Kaplan and Strömberg (2003), US venture capital firms use extensively convertible preferred stocks. However, the use of convertible securities is relatively

limited in Europe, which can be explained by the different institutional frameworks (Schwienbacher, 2008). Interestingly, evidence shows that lack of experience and sophistication is not related to the level of use of these securities (Cumming, 2007).

It can happen that the management does not want to sell their share at all at the time of the exit of the venture capital firm. This might be the case because management has various motives but venture capitalists aim only at reaching the highest return on investments. Therefore, it is highly recommended to inform the management about the possible exit scenarios and the timing of those at the time of investment. Venture capitalists include certain provisions, e.g. drag along or tag along rights, in the shareholder's agreement that can oblige the management in such cases. In general, well-managed co-ownership and the properly implemented incentive programmes for the managers are key elements of venture capitalists' business model and they might ensure a relatively smooth exit. (Andersen, 2015)

2.2.3 The Advantages and Disadvantages of Initial Public Offering

According to Andersen (2015), going public means the portfolio company achieves a stock market listing and sells shares in the primary market that results immediate change in the ownership structure (usually a broader dispersion). Additionally, it ensures access to capital market financing in the future. Additionally, IPOs imply high degree of alignment of interest between shareholders because listing is regarded as success and management will typically retain their position in the company.

Academic wisdom traditionally regards stock exchange listings as venture capitalists' favourite exit from a portfolio company. For example, Gompers and Lerner (1997) and Amit et al. (1998) find that venture capitalists deliver most of their profits by IPOs. Additionally, Brau et al. (2003) document a valuation premium of 22% for IPOs over acquisition exits. Furthermore, Cumming and MacIntosh (2003) find that average annual rates of return to VCs are 84% in IPOs, and only 20% in trade sales. Gompers (1995) documents 60% average annual rate of return for IPOs and only 15% for trade sales. To further support this findings, Brau et al. (2003) document higher valuations with 22% for going public over trade sales.

However, the bursting of the bubble has changed their strategies and there is no clear consensus on the favoured exit routes. Bessler and Seim (2011) also realise that IPOs are

not the most preferred exit routes of VCs from certain reasons. Da Rin et al. (2011) argued that IPOs were the most important exit route in the US until 2000, but their role has lost significance. Ball, Chiu, and Smith (2011) also reached the same result.

Roell (1996) lists the advantages of public listings, namely, access to new financing, increased company image, increased motivation for employees and management. Hence, IPOs are incentives for all shareholders. However, IPOs are suitable exit routes only for companies that reached a certain value, position and attention on the market. Venture capital-backed firms are sometimes not able to fulfil the requirements for listing. Moreover, listings have a few disadvantages as well. For example, venture capital firms are usually not able to sell all of their stakes in the company upon IPOs since the market expects that major shareholders stay invested in the company signalling confidence. It is a best-practice from investment banks to apply a lock-up period of 6 to 18 months to all the existing shares which does not allow shareholders to sell their stakes during this time period. This obligation has clearly an effect on PE funds' return. As further disadvantages can be mentioned that IPOs are lengthy and expensive processes and PE funds usually lose their preference rights after a listing. Finally, listing of a well-established mature industrial portfolio company is considered much more secure than listing of a small venture capital-backed technology firm.

2.2.4 Alternatives for IPO

Trade sale

Academic research has shown that trade sale to a strategic or financial buyer is one of the most popular exits. Cumming (2007) argues that in a trade sale the VC stake is sold to a strategic investor in order to integrate the venture into the company. A strategic investor can benefit from the deal by gaining access to R&D, patents, and technology. If there are exploitable synergies or other benefits a trade sale might offer a more profitable exit than other routes such as an IPO. In addition, the success of a trade sale may be influenced less by actual market conditions than in case of an IPO.

Recapitalisation

This type of exit uses borrowings to pay dividend to the investors, in this case the private equity fund. Larger companies might issue bonds and finance dividend payouts with the help of proceeds from this issue.

Spin-outs and break-ups

It includes dividing up companies and restructurings of portfolio companies in order to create or save value.

Selling back to the entrepreneurs or the company

If there is no potential buyer for the portfolio company fund managers might try to sell the shares back to the company or to the management. However, this type of exit is rare since most of the time the management does not have the financial resources to pay for the shares. A buy-back can be organised at the time of investment by using put option. This agreement makes shareholder able to sell the shares back to the management (put option) or to the company (redemption provision) on an agreed date and at an agreed price. Normally, it allows the fund manager to exit the investment and redeem the originally investment amount after a few years. Provisions like this are used to discipline the management if it does not cooperate with the investors. Conversely, the management might have the right to buy the shares back (call option).

Sale of portfolio companies to secondary funds

Since fund managers invest and sell companies cyclical it can happen that a portfolio company is really hard to sell. In those cases, the PE fund can sell shares in one or even in more portfolio companies to secondary funds which are specialised in acquiring stakes in portfolio companies from other PE funds.

Liquidation or insolvency

It can also happen that the portfolio company does not fulfil the expectation and the fund manager decides to liquidate the company.

2.2.5 The Role of Reputation in the VC Market

Reputation's effect on the ability to raise new capital is one of the major topics in corporate finance. For example, Diamond (1989) documents that reputation plays an important role in accessing debt and equity markets. Smith and Smith (2000) argues that an investor in limited partnership structure should be cautious because 'At the beginning of a partnership the limited partners have all the money and the general partners has the experience, but at the end, the general partners has all the money and the limited partners have the experience.' However, venture capital firms receive most of their capital from institutional investors who continuously monitor general partners. Not to mention, that reputation plays an important role as well. In order to operate successfully and raise funds cyclical, they have to find the best-performing ventures and carry out deals that are beneficial both for the investors and for the entrepreneurs.

Smith and Smith (2000) also argue that reputation plays a role in most of the markets. Reputation of all parties, such as VCs, investors, end entrepreneurs, is substantial. For example, VCs prefer to raise money from institutional investors instead of individuals and well-established, serial entrepreneurs are able to raise capital faster and easier than first-time founders. Not to mention, that VCs with reputation are able to charge higher fees and carried interest due to the expectations that their overall performance will be higher than of other competitors.

Megginson and Weiss (1991) document that VCs' reputation might be guarantee for taking firms to the public market due to their experience and expertise related to IPOs. This implies that VCs own reputational capital and such a reputation is costly. Hence, the present value of lost reputational capital by taking firms with bad quality is greater than a one-time gain from such a movement. The authors state that staying invested before and after the IPO works as a bonding mechanism and support VC certification due to the fact that the VC could not benefit from higher share price over a short period of time.

2.3 Short-term Financial Performance of VC-backed IPOs

Traditionally, scholars focus on the size of the underpricing and the long-run market performance when they examine the return and performance characteristics of public listing. Normally, underpricing is calculated as the difference between the stock price at the end of the first trading day and the offer price. The empirical findings of existing studies are introduced in this sub-section.

Informational problems can arise times when private equity is offered to the public which is not specific only to the venture capital market. One of the most researched informational problems is the phenomenon underpricing. Academics find that IPOs are underpriced, on average, by about 16 percent (Ibbotson, Sindelar and Ritter, 1994).
Generally, academic literature considers underpricing of IPOs as the existence of premarket information asymmetry and as a compensation of public investors. According to Rock (1986), underpricing is a discount which might be required by uninformed investors who face the problem of asymmetric information. Grinblatt and Hwang (1989) argue that underpricing can be viewed as a signal to public investors regarding the quality of the issue. Francis and Hasan (2001) describe this phenomenon as *deliberate underpricing*. However, Ritter (1991) documents IPOs with overpricing. Academic literature identifies several explanations, such as costly information acquisition, bandwagon effect, signalling, ownership dispersion (Ritter, 1995).
However, venture capital investments are generally associated with high level of risk (Carleton, 1986). Additionally, VC-backed companies are being taken public at an earlier development stage than non VC-backed firms, which suggests that the level of information asymmetry is higher for venture-backed IPOs (Megginson and Weiss, 1991). Thus, higher underpricing should be expected for VC-backed public listings compared to non VC-backed ones.
The role of venture capitalists in IPO processes are examined by several scholars, such as Barry et al. (1990), Lerner (1994), Megginson and Weiss (1991), Sahlman (1990) and Ritter (2012). Academics argue that venture capitalists are permanent IPO market players which can lead to less underpricing (Neus and Walz, 2005).

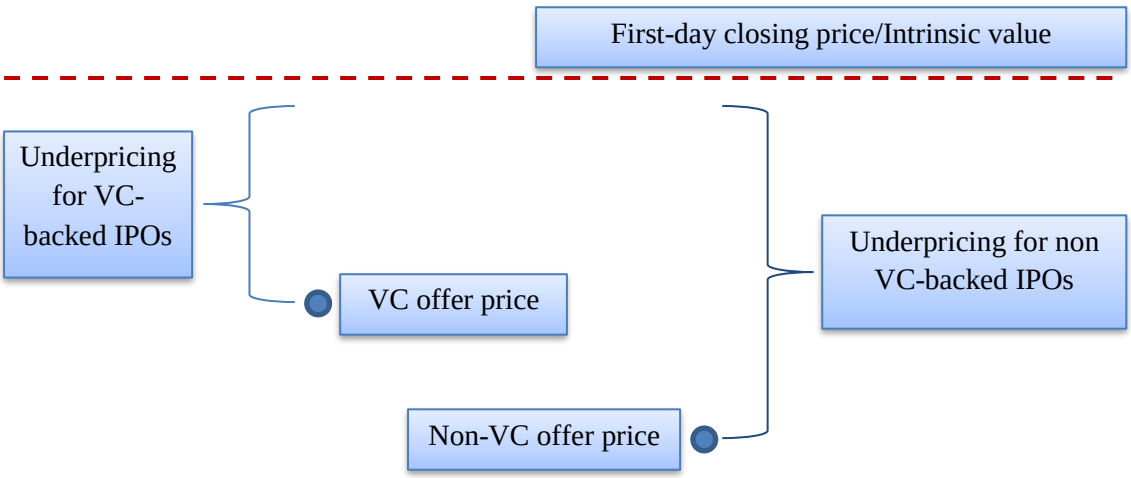
In contrast to the certification theory, it seems plausible that IPO firms are overpriced by VCs due to the fact that financial sponsors' return are stemming from the difference between initial investments and exit proceedings. This theory is supported by the fact as well that venture capital firms have board seats, voting rights and other tools to influence the timing of an IPO.

Additionally, Hadryd, Mietzner and Shciereck (2010) analyse underpricing and long-term performance of private equity-backed IPOs. The authors assert as well that information asymmetry plays an important role in the behaviour of market participants. Evidence is documented that VC-backed listings are associated with larger underpricing than buyout capital-backed listings. The finding has been explained by the fact that buyout funds back more stable and mature companies from established industries, whereas venture capital funds are engaged in a market with higher risk.

2.3.1 Certification Hypothesis

Third party certification imply value whenever securities are issued in capital markets and external investors have less information than insiders regarding the value of the offering firm. Since insiders tend to hide or distort information in order to maximise proceedings from the deal, public investors offer lower price due to information asymmetry (Akerlof, 1970). Hence, public investors are convinced "…that accurate information disclosure has occurred only if a third party, with reputational capital at stake, has asserted such and will be adversely and materially affected if that assertion proves false." (Megginson and Weiss, 1991).

Figure 4: Illustration of the Certification Hypothesis



Source. Own creation

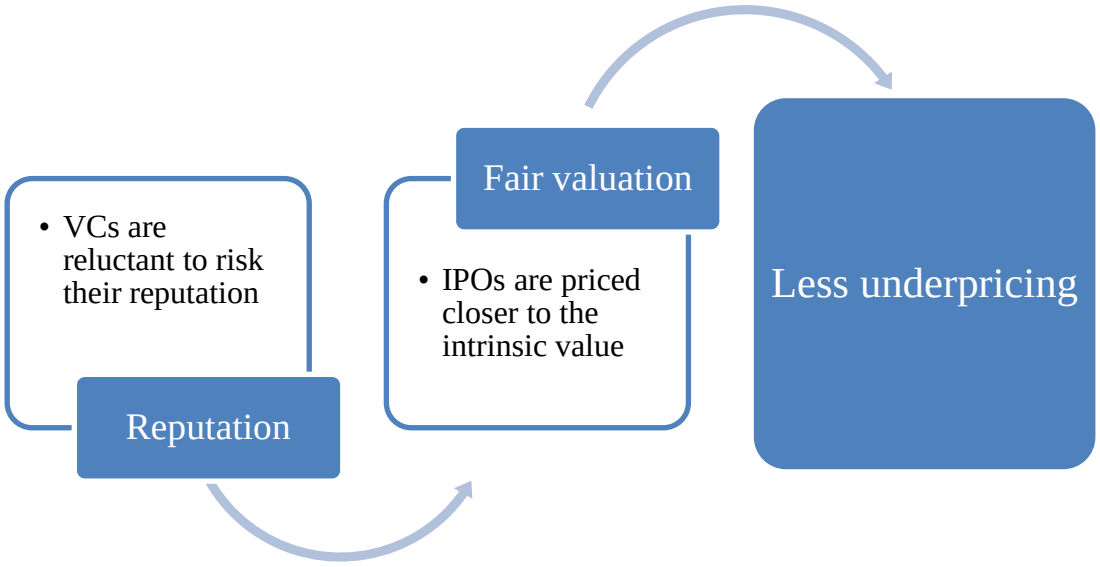
According to Megginson and Weiss there are three conditions to be met by a third party to believe that the certification role has value:

i. Reputational capital is at stake.
ii. The present value of this reputation capital is larger than any one-time gain from certifying falsely.
iii. Costly certifying services for the issuing firm.

The authors argue that there are strong reasons to believe that these tests are met by venture capital firms.

One would expect that venture capitalists are sensitive to any negative reputational effect that may occur by taking an overpriced firm public. Consequently, close-to-real-value offer prices and prudent behaviour should be observable for more experienced and reputable VC firms. Hence, one would expect lower underpricing and a superior long-run performance from venture capital-backed listings compared to non venture-backed IPOs. This is the *certification of value* theory (Megginson and Weiss, 1991). The authors find that venture capital-backed IPOs were less underpriced than non VC-backed IPOs during 1983-1987. This finding supports the certification hypothesis, meaning that venture capital firms price IPO close to their intrinsic value.

Figure 5: The Mechanism of the Value Certification



Source. Own creation

Clearly, venture capitalists can build up and maintain reputation by not selling extremely mispriced shares publicly. Reputation allows these venture capital firms to sell shares and redeploy human capital with less concerns related to negative market reactions (Lin and Smith, 1998). The authors document that more experienced VCs are more likely to decline taking a company public with underpriced shares.

Bessler and Seim (2011) argue as well that involvement of venture capital firms at early stage could be a superior certification of the quality of the firm and its IPO. This would imply that venture-backed IPOs should result in smaller underpricing and better long-term performance compared to non venture-backed firms. The authors examine European VC-backed IPOs and find that they outperform the market in the first and second years post-listing, but not for longer time period. However, there is no academic consensus regarding this statement.

Barry et al. (1990) document that VC-backed IPOs were less underpriced than non VC-backed IPOs between the time period 1978-87. The authors explain the outcome by the *screening and monitoring* theory. It argues that venture capitalists select high-quality firms and add value by monitoring them permanently. Hence, these activities should imply that venture-backed IPO firms represent higher quality than non venture-backed

counterparts. Barry et al. also document that venture capitalists stay invested in the portfolio companies after an IPO, which is associated with better survival rate for those IPOs reached by giving strategic advice, increase visibility to institutional investors and to other interested market players.

However, more recent papers showed different findings. Lee and Wahal (2004) find that VC-backed IPOs are more underpriced between 1980 and 2000. Loughran and Ritter (2003) reach similar results.

Chemmanur and Loutskina (2006) approach the topic from a new perspective. Alternatively, Chemmanur and Loutskina state that there are three possible roles for venture capital firms in an IPO, namely, *certification*, *screening and monitoring* and *market power*. The authors argue that these roles might influence the post-IPO performance. The certification hypothesis states that venture capital firms are permanent players on the IPO market, thus, they are concerned about their reputation and they are more averse to overprice IPOs. The screening and monitoring hypothesis assumes that the venture capitalists are able to successfully screen and monitor portfolio companies which can result in taking public firms with higher quality. The market power hypothesis implies that venture capitalists' objective is to obtain the highest price possible in these IPOs with the help of their ability to attract more attention among market participants. Hence, the market power hypothesis has substantially different implications regarding IPO pricing. It is asserted that the market hypothesis is being supported by the behavioural argument, that is, public investors are excessively optimistic about the future prospects of the IPO firms (Loughran and Ritter, 2002; Purnanandam and Swaminathan, 2004).

The authors reject the certification hypothesis, while found evidence for the market power hypothesis and for the screening and monitoring hypothesis. Thus, IPO can result in higher valuations for the equity of these firms. Consequently, evidence suggest that venture capitalists are willing to obtain higher valuation due to their reputation among limited partners and entrepreneurs, which has a substantial effect on subsequent fund raising. This finding is consistence with the findings of Gompers and Lerner (1998).

The results of the paper find that both venture-backed and non venture-backed IPOs were overpriced at the time of IPO. Moreover, VC-backed IPOs are significantly more overvalued than non venture-backed IPOs, median overpricing of 59% and 28%, respectively. Furthermore, high-reputation venture-backed IPOs are more overvalued

than IPOs backed by low-reputation VCs. These findings clearly reject the certification hypothesis and support the market power hypothesis. Therefore, it seems venture capitalists attract high quality market players to the IPO. Finally, the authors also find that VC-backed entities had higher quality operating performance than non-sponsored entities that partly supports the screening and monitoring hypothesis.

Neusand Waltz (2005) showed that VC sponsors have incentives to report the true quality of their portfolio companies during the IPO process. Hence, one can see that reputational risk might have an effect on valuation and on the underpricing of IPOs.

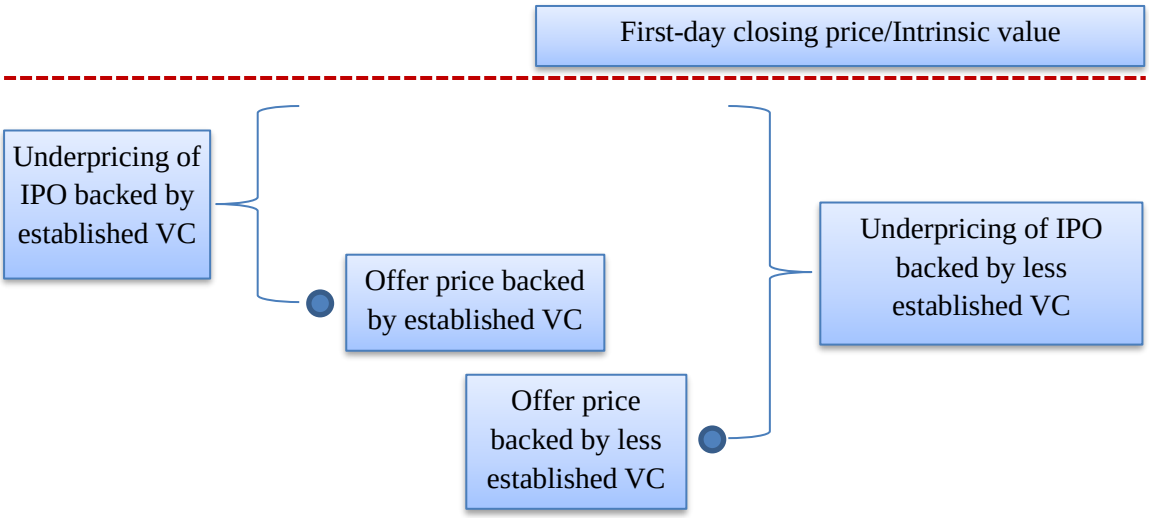
Kraus (2002) tests the certification role in relation to IPO underpricing as well. Kraus argues that VC-backed IPOs are less underpriced than non-backed ones but within one month after the listing the underpricing disappears when controlling for hot markets and underwriter reputation.

Surprisingly, scholars find evidence that VCs with higher level of reputation tend to undertake public listings with larger underpricing (Tyková and Walz, 2007).

2.3.2 Grandstanding Hypothesis

It is shown that venture capitalists might be associated with the phenomenon *grandstanding* which hypothesises that less experienced VCs might take portfolio companies public too early. They are willing to signal an appealing track record to attract capital. Consequently, young venture capital firms take portfolio firms public earlier than more established venture capital firms. The grandstanding hypothesis, introduced by Gompers (1996), states that venture capitalists may exit their investments in good market conditions which allows them to build up reputation and support fund raising. The author also shows that less experienced VCs are desperate to raise new funds shortly after IPOs. Although grandstanding can shorten the incubation period for portfolio companies, Hsu (2009) points out in his research that longer incubation period has several positive effects on performances of companies (more patents, above average operating performance subsequent to listing).

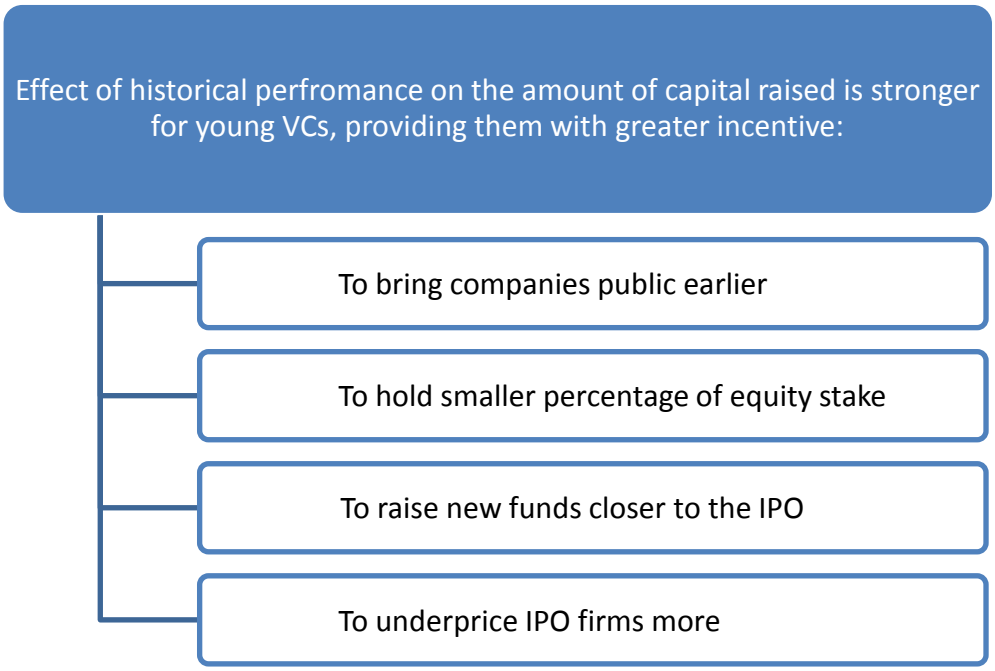
Figure 6: Illustration of the Grandstanding Hypothesis



Source. Own creation

In sum, VCs may manage two or three fund simultaneously, each raised three to six years after the previous fund. Institutional investors as limited partners do not participate in policy decisions, thus, assessing a venture capital firm's ability is difficult. Therefore, limited partners must search for signals of ability. Gompers and Lerner (2006) find that successful exits are critical to venture capital firms since they have to deliver high positive return, which has immense effect on raising capital for future funds. Further academic results also suggest that the relation between IPO performance and ability of capital raising influences the incentives and actions of venture capitalists. Hence, grandstanding is another example how venture capitalists can behave opportunistically which might lead to decisions that are not in the best interest of their portfolio companies.

Figure 7: Implication of the Grandstanding Hypothesis



Source. Own creation

Lee and Wahal (2004) introduce a variant of the grandstanding hypothesis. After analysing first-day returns of 6,413 VC-backed and non-backed IPOs from 1980 to 2000, they find larger average first-day returns for VC-backed listings. The authors also argue that venture capital firms have an incentive to underprice IPOs since the media attention around a successful listing enables them to raise more capital. Lee and Wahal prove this hypothesis by showing positive relationship between first-day returns and future fund-raising by venture capital firms. The positive relationship persists even after controlling for the age, size, and history of the VC firm.

Gompers and Lerner (2000) state clearly that grandstanding indicates that venture capital firms signal their ability to potential investors. This could explain why young VC firms bring companies public earlier than older venture capitalists in order to establish a reputation. Young venture capital firms have been invested in the portfolio company fourteen months less and hold smaller percentage equity stakes at the time of IPO than the more established venture firms. These portfolio companies are approximately two

years younger and more underpriced when they go public than companies backed by well-established VC firms. The results further prove that the relation between performance and the ability to raise capital affects the incentives and actions of venture capital firms. Barry et al. (1990) also find that VCs with more experience are accompanied with smaller underpricing. Nahata (2008) documents that cumulative capitalization of IPOs of VCs are in relation with successful IPO exits.

3 Hypotheses

Our paper focuses on the underpricing of VC-backed and non VC-backed IPOs in Europe and in the US. In this chapter, we introduce our hypotheses with which we try to predict the existence of differences regarding the aforementioned phenomena and geographical location. We base our hypotheses on academic theory and empirical evidence.

3.1 Certification Hypotheses

Academic literature tends to use information asymmetry as a starting point to explain underpricing which is considered as an effective way to convince external investors on the quality of an IPO. Empirical evidence shows that private equity firms are able to mitigate information asymmetry by their value added activities (Megginson and Weiss, 1991; Brav and Gompers, 1997; Schöber, 2008). Hence, we believe that venture capitalists create a higher level of certification which can be seen as a smaller information asymmetry gap. Consequently, we predict that VC-backed IPOs are less underpriced than non VC-backed IPOs when shares are offered to the public.

H_1: Venture-backed firms present less underpricing at IPOs than companies that are not backed by venture capitalists.

H_2: Venture-backed IPO firms from the US present lower level of underpricing than European venture-backed entities.

H_3: VC-backed IPOs are underpriced more during hot market periods.

H_4: VC-backed IPOs are associated with lower firm age.

H_5: VC-backed IPOs are associated with smaller offer size.

H_6: VC-backed IPOs are associated with longer lock-up periods.

3.2 Grandstanding Hypotheses

In our research, we try to analyse whether less experienced venture capitalists tend to undertake actions which could signal ability and improve track record. We expect that the phenomenon grandstanding exists in the venture capital industry which can be proved by our data set.

H_1: Less experienced venture capital firms take portfolio companies public with a higher level of underpricing.

H_2: Less experienced venture capital firms take portfolio companies public faster, and at an earlier stage of their development.

H_3: Less experienced venture capital firms take smaller portfolio companies public.

H_4: Less experienced venture capital firms benefit more from high-quality underwriters since these IPOs might be associated with more risk.

4 Sample and Methodology

This chapter provides a comprehensive description of the process of the data collection and presents the chosen variables. We show how we match VC-backed IPOs with non VC-backed ones. In the next, sub-chapter, we analyse the time series of initial public offerings and the underpricing of our sub-samples. Finally, we present the tables of descriptive statistics of the chosen variables and describe the methodology of our study.

4.1 Sample

There is no strictly defined method on sample identification in academic literature. In this chapter, we introduce commonly used approaches and we include the description of the selection criteria and sources applied by us to identify our samples. Academics argue that the classification of private equity and venture capital entities and deals are challenging due to fragmented information and the unclear line between asset classes and deals (Muscarella and Vertsuypens, 1989; Cao and Lerner, 2006). Normally, industry publications, financial newspapers, IPO prospectuses and other financial databases are used for identification and classification.

Consistent with a lot of empirical researches, which use US market data as benchmark, my research examines underpricing of the VC-backed IPOs in the US and in Europe.

We use Bloomberg and Thomson One as the best available sources to undertake our research. We use these databases to list all public offerings which received venture capital funding and those which did not such. Additionally, the available information on the website of the stock exchanges, companies, EVCA, and NVCA provide us with useful information.

Other IPOs backed by other types sponsors are considered as non-ventures-backed IPOs and are not distinguished from non-backed IPOs. We do so, because the focus of this paper is on venture capital, and analysing separately other types of private equity sponsorship would far exceed the scope of our research. This is clearly reflected by the large amount of existing academic papers about buyout funds and their activity. Moreover, we assume that buyout-backed IPOs are not much different from non-backed IPOs knowing that buyout funds bring more mature companies from established industries to public markets.

Our paper restricts the sample to non-financial, Western European and US-based companies which were taken to public between 2000 and 2015. Western Europe includes the UK, France, Germany, Spain, Switzerland, Italy, The Netherlands, Sweden, Norway, Ireland, Luxembourg, Belgium, Austria, Greece, Denmark, Cyprus, Finland, Portugal, and Malta.

Having filtered the duplicate listings, we end up a sample of 4,452 IPOs. The sample size is an important part of this section. Looking at the other papers, we can realise that sample size can vary extremely from only 120 to more than 3,000. Our sample from the European region consists of 1,745 IPOs. As one could expect, the US sample, which includes 2,707 records, is approximately one and a half times greater than the European one. The above-mentioned procedure left us with a venture capital-backed IPO sample of 1,474 records. The European and the US sample consist of 265 and 1,209 records, respectively. However, sample size shrinks when we use initial returns, as the measure of underpricing, in our analyses.

The time period is also a crucial point when it comes to data. We realise that there is lack of studies which investigate these IPOs around 2010 and onwards. Hence, a study like ours can bring new findings to the surface. As the beginning point of time, we choose 2000 so that we can analyse a longer time interval and examine IPO waves and economic cycles.

The first step is to gather Western European and US historical stock information and company information for non venture-backed IPOs from Bloomberg. We collected all of the initial public offerings, active and inactive, in the US and in Western European countries. Secondary issues, pending, withdrawn or cancelled IPOs cannot be found in our sample data. Records that are not involved with common equity issues are eliminated. Furthermore, the IPO firm should not be a unit offering, closed-end fund, or a real estate investment trust (REIT). As the next step, we derive Western European and US historical stock information and company information for venture capital-backed IPOs from Thomson One. Since the Bloomberg sample includes all IPOs, we had to exclude the venture capital-backed listings manually with the help of the ticker names. Companies' balance sheet items and other financial data are downloaded in USD and in EUR, for the US and for Europe, respectively. Penny stocks, i.e., listings with less than 1 USD or 1

EUR offer price are also excluded. If records have zero or missing values for important variables we assume the data unreliable and exclude it from our analysis. IPOs with less than USD/EUR 5.0 million are also excluded from the lists.

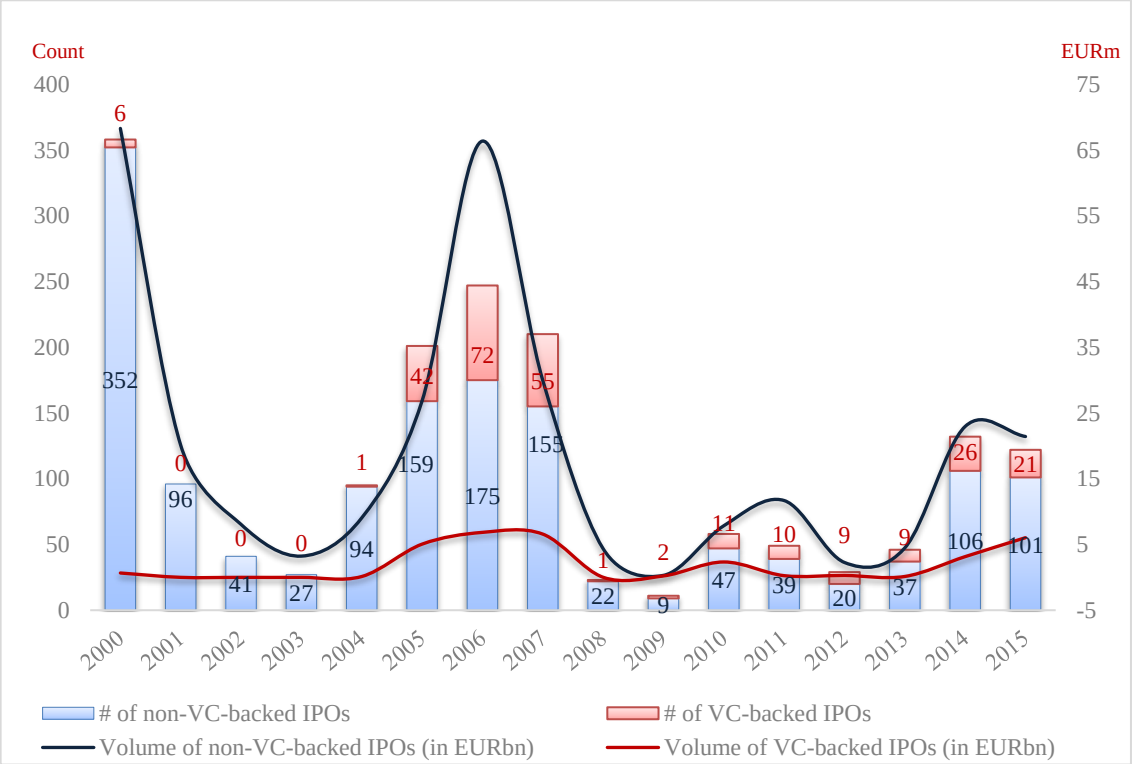
For each IPO, we collect information on net proceeds, the number of shares offered, filing date, effective date, company founding date, country in which the firm is headquartered, industry and sector, lock-up date and period, name of the stock exchange, offer currency, and share price for the first trading day. Our tests require special information on venture capital investments in IPO firms. We obtain these data from the Thomson One database on the number and names of venture capital firms with an investment in each IPO at the time of the offering, the date of the first financing rounds, the number of financing rounds before IPO, and the participating underwriters.

Unless otherwise noted, for the reported statistics, tests and regressions we use variables that are trimmed at the lower and upper half percentile.

4.1.1 Description of the European and US IPO Market

The distribution of the number and the volume of the European IPOs throughout the chosen time interval on an annual basis are showed in Figure 8.

Figure 8: The Number and Volume of European IPOs by Years, 2000-2015

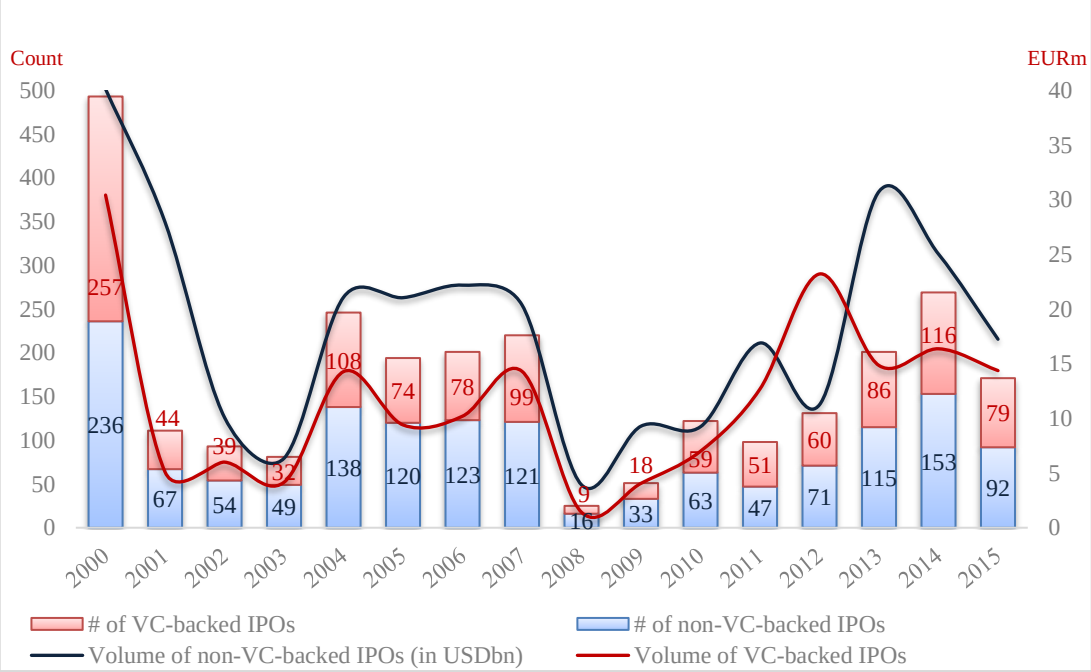


Source. Bloomberg and Thomson One, own creation

IPOs are divided by the type of sponsorship, namely, venture-backed listings and non venture-backed ones. Most visibly, the peaks around the financial crises are depicted. The development of the European IPO market is best characterised by two distinct time periods, so that it seems appropriate to divide our analysis into the following periods: 2003 to 2007 and 2008 to 2015. However, it is interesting to see that 2000 and the following two years, when the *dot.com* bubble burst, was dominated by non venture-backed listings. This could be explained by the fact that the European venture capital market still lagged behind the US and that the "new economy" and the global boom had a different impact on Europe. The first period of our analysis covers the time before 2007. After the recovery, in 2003, the venture capital market started to grow impressively, up to €73 billion at the end of 2006, which is as large as it was in 2000. After the peak, the number of total IPOs falls below 24 listings. The second market cycle shows slightly different growth dynamics with the number of IPOs strongly increasing in 2014. In 2015, nearly 20 European companies that were backed by venture capitalists went public.

The distribution of the number and the volume of the US IPOs throughout the chosen time interval on an annual basis are showed in Figure 9.

Figure 9: The Number and Volume of US IPOs by Years, 2000-2015



Source. Bloomberg and Thomson One, own creation

Most visibly, the same market developments can be recognised. We observe a large decrease regarding the number and volume of IPOs in the years after the dot.com bubble. In 2004, the number of IPOs increased up to 246. Surprisingly, there was no dramatic increase from that year on neither in the number of listings nor in volume. In the second period, both venture-backed and non venture-backed IPOs increased steadily, up to nearly 270 public listings. In 2015, there were 171 IPOs in the US of which approximately half of them were venture-backed deals.

Looking at the graphs, it becomes clear that the relative size of the US venture capital market, represented by IPOs, are exceedingly larger than the European ones both in number of listing and in volume. Meanwhile, there is no substantial difference in non venture-backed IPOs between the two markets. Hence, our data is consistent with both the industry wisdom and empirical evidence.

Both graphs reflect that 2013 was a turning point in the venture capital market. Improving economic condition, increasing levels of liquidity accompanied by higher level of investor confidence, and more positive exit environment contributed to the increase of venture capital investments and exits for 2013 onward.

Table 1 shows the distribution of IPOs according to industry classification, geography, and year. First of all, it is inevitable that the two regions provided approximately the same amounts of non VC-backed public listings throughout the years. Clearly, the same industries appear to be the favourable for IPOs, namely, communication, non-cyclical consumer, and technology industry. Surprisingly, industrial companies do not seek to go public in the US, however, in Europe more of these companies see public listings attractive. The VC-backed IPOs show similar distributions. In the US, the technology industry leads the list followed by non-cyclical consumer industry, which is driven by the biotechnology subcategory. In Europe, producers and service providers from the non-cyclical consumer industry dominate the VC-backed IPO market. In sum, favourite sectors are overwhelmingly consumer products and services, and information technology. According to Ernst &Young (2015), consumer services have direct connection with consumers that provides fast feedback and path to value realisation. Clearly, this sector is more preferred in Europe. They find as well that IT is still the leading sector of venture capital industry, while health care investments are particularly popular in mature markets like Europe or the US.

Table 1: Distribution of VC-backed and non VC-backed IPOs

Industry classification are taken from *Bloomberg*. Geographical distribution is created by the country of stock exchange in which the IPO happened. Sub-periods are created by us based on IPO market data.

Panel A: Industry distribution of VC backed IPOs

	Europe		US	
Industry	Non VC-backed	VC-backed	Non VC-backed	VC-backed
Basic Materials	64	0	29	1
	(4.37%)	(0.00%)	(1.97%)	(0.10%)
Communications	274	15	219	104
	(18.78%)	(6.36%)	(14.88%)	(9.26%)
Consumer, Cyclical	199	23	168	68
	(13.64%)	(9.75%)	(11.41%)	(6.06%)
Consumer, Non-cyclical	345	103	564	455
	(23.65%)	(43.64%)	(38.32%)	(40.52%)
Energy	105	15	100	22
	(7.20%)	(6.36%)	(6.79%)	(1.96%)
Industrial	257	17	121	24
	(17.61%)	(7.21%)	(8.22%)	(2.14%)
Technology	196	63	256	449
	(13.43%)	(26.69%)	(17.39%)	(39.98%)
Utilities	19	0	15	0
	(1.31%)	(0.00%)	(10.19%)	(0.00%)
Total	1459	236	1472	1123
	(100%)	(100%)	(100%)	(100%)

Panel B: Geographic distribution of VC Backed and Non VC-backed IPOs

Country	Non VC-backed	VC-backed	Country	Non VC-backed	VC-backed
US	1472	1123	Spain	24	7
Britain	488	59	Portugal	6	1
France	212	77	Ireland	13	2
Norway	58	17	Switzerland	30	14
Germany	253	29	Austria	26	4
Italy	145	9	Greece	61	0
Sweden	54	13	Denmark	21	7
Finland	25	2	Belgium	28	16
Luxembourg	9	0	Netherlands	25	6
			Total	2950	1386

Panel C: Time-series distribution of VC Backed and Non VC-backed IPOs

	Europe		US	
Year	Non VC-backed	VC-backed	Non VC-backed	VC-backed
2000	352	6 (1.68%)	236	257 (52.13%)
2001-2003	164	0 (0.0%)	169	115 (40.49%)
2004-2007	583	170 (22.58%)	501	359 (41.74%)
2008-2012	137	33 (19.41%)	228	197 (46.35%)
2013-2015	240	56 (18.92%)	359	281 (43.91%)
Total	1476	265 (15.22%)	1493	1209 (44.74%)

Table 1 Panel B depicts the distribution of IPOs according to geographical location. Most visibly, the US dominate the IPO market in both categories. Unsurprisingly, the number of the venture capital-backed listings reflects the size of the entire venture capital markets in these two regions. In Europe, we can mention Britain, France, Germany and the Nordic countries as one of the most active IPO markets in both categories.

Academic wisdom states that there are waves in IPO activity (Ritter, 1984; Lowry and Schwert, 2002). Table 1 Panel C presents the distribution of initial public offerings in time arranged by geography and type of sponsorship. Bessler and Seim (2011) also

analyse the European IPOs for different time periods which cover two market cycles. We also find that the number of IPOs in the different sub-periods follows closely the economic cycles which supports the view that IPO market moves with the economy.

4.1.2 Description of the Level of Underpricing

We have calculated the first-day returns for the US and European IPOs which present valuable information regarding our research. We test whether there are statistically significant differences in underpricing. For this exercise two-tailed t-statistics test and Wilcoxon-Mann-Whitney rank-sum test are applied. The Mann-Whitney test compares the distribution of ranks in two groups. If we assume that both populations have distributions with the same shape, it can be viewed as a comparison of two medians.

Table 2 presents the descriptive statistics of the underpricing characteristics of our samples and sub-samples. Panels A and B present median and mean statistics based on the full IPO sample. Table 3 shows only pair-matched underpricing characteristics. Following Lee and Wahal (2004), each VC-backed IPO is matched with a non VC-backed IPO by a two-digit SIC industry classification and offer size. Our underpricing characteristics are consistent with those of previous studies (Lee and Wahal; Loughran and Ritter, 2003), showing that our sample is similar to those used in these studies.

The final sample consists of 175 and 957 VC-backed deals and 1,446 and 1,458 non VC-backed ones in Europe and in the US, respectively. The average underpricing for Europe and for the US are 6.49% and 21.17%, respectively, with the medians being 3.89% and 10.65%, respectively.

As we have already mentioned, it is inevitable that VC-backed IPOs have a significantly larger role in the US IPO market. Only 10 percent of all IPOs are venture capital-backed in Europe, while this number is close to 40 percent in the US. Surprisingly, the mean and median initial returns for the two types of IPOs do not differ significantly. However, these values differ significantly for the US. Most surprisingly, the European IPOs are being underpriced around 6 percent, while public listings of non VC-backed and VC-backed IPOs in the US show 15.9 and 29.2 percent first-day returns, respectively. Hence, our findings regarding the US IPO market are similar to previous studies (Lee and Wahal; Megginson and Weiss, 1991), which find that VC-backed IPOs experience significantly

higher underpricing compared to non VC-backed offerings. As for the offering size, both in Europe and in the US the venture-backed IPOs are smaller in size, but they do not differ statistically. Not surprisingly, the VC-backed offers tend to be higher by €50 million in the US. The amount of 'money left on the table' represent the same characteristics that values of initial returns depict. We find that the average amount of 'money left on the table' for the full sample is €7.95 million and 32.90 million in the Europe and in the US, respectively.

Table 2: Underpricing of VC-backed and non VC-backed IPOs

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day. Following Lee and Wahal (2004), each VC-backed IPO is matched with a non VC-backed IPO by a two-digit SIC industry classification and offer size. Amount of money left on table is calculated as the difference between the first-day closing price and offer price multiplied by offer size. Tests of differences in initial return using use a difference in means t-test and Wilcoxon rank-sum test for testing medians. Difference in offer size and amount of 'money left on the table' are also presented. Medians are in brackets. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. P-values for the statistical tests are in parentheses in the last two columns.

	Full Sample	Venture Capital Backed	Non venture capital-backed	Difference in Means (p-value)	Difference in Median (p-value)
Panel A: Comparison of the European Sample of VC Backed and Non VC-backed IPOs					
Number of IPOs	1621	175	1446	-	-
Percent of the full sample	*100%*	*10.8%*	*89.2%*		
Percentage of IPOs with positive initial returns	72.3%	71.4%	72.4%	-	-
Mean initial return (%)	6.49	6.05	6.55	0.49	0.16
	[3.89]	[4.00]	[3.84]	(0.8335)	(0.9841)
Mean offer size (€ million)	200.90	117.74	210.96	-93.22	2.99
	[37.13]	[40.00]	[37.01]	(0.2697)	(0.5141)
Mean amount of 'money left on the table' (€ million)	7.95	10.41	7.65	2.76	1.23***
	[0.00]	[1.23]	[0.00]	(0.2482)	(0.0004)
Panel B: Comparison of the US Sample of VC Backed and Non VC-backed IPOs					
Number of IPOs	2415	957	1458	-	-
Percent of the full sample	*100%*	*39.6%*	*60.4%*		
Percentage of IPOs with positive initial returns	75.7%	80.6%	72.5%	-	-
Mean initial return (%)	21.17	29.15	15.92	13.23***	7.49***
	[10.65]	[15.56]	[8.07]	(0.0000)	(0.0000)
Mean offer size (€ million)	180.29	157.44	195.30	-37.86	-2.28
	[90.40]	[89.72]	[92.00]	(0.1046)	(0.5460)
Mean amount of 'money left on the table' (€ millon)	32.90	46.90	24.17	22.73***	9.06***
	[9.41]	[15.81]	[6.75]	(0.0000)	(0.0000)

According to several academic paper (Megginson and Weiss (1991); Lee and Wahal (2004)), we also match the VC-backed IPOs to non VC-backed IPOs by offering size, and industry classification. Our matched samples show only a slightly different picture regarding underpricing. Consistent with the certification hypothesis, the average

underpricing for the European and the US VC-backed IPOs is 6.05% and 29.15% compared to -1.83% and 18.32% for the matched sample of non VC-backed IPOs, respectively, and the difference in initial returns is statistically significant for both regions. Most importantly, the European non VC-backed IPOs are overpriced on average and statistically different from the VC-backed ones. These findings are similar to the results of Megginson and Weiss but differ from the ones found in the study by Barry et al. (1991). As we expected, VC-backed firms are taken public with lower firm age than are non VC-backed entities, on average. Furthermore, mean length of lock-up periods tend to be shorter for venture-backed companies both in the US and Europe.

Table 3: **Underpricing of VC-backed and 'Matched' Non VC-backed IPOs**

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day. Following Lee and Wahal (2004), each VC-backed IPO is matched with a non VC-backed IPO by a two-digit SIC industry classification and offer size. Amount of money left on table is calculated as the difference between the first-day closing price and offer price multiplied by offer size. Tests of differences in initial return using use a difference in means t-test and Wilcoxon rank-sum test for testing medians. Difference in offer size and amount of 'money left on the table' are also presented. Medians are in brackets. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. P-values for the statistical tests are in parentheses in the last two columns.

	Full Sample	Venture Capital Backed	Non venture capital-backed	Difference in Means (p-value)	Difference in Medians (p-value)
Panel A: Comparison of the European Sample of VC Backed and "Matched" Non VC-backed IPOs					
Number of IPOs	350	175	175	-	-
Percent of the full sample	100%	*50%*	50%		
Percentage of IPOs with positive initial returns	74.0%	71.4%	76.6%	-	-
Mean initial return (%)	2.11	6.05	-1.83	7.88***	0.52
	[3.66]	[4.00]	[3.48]	(0.0052)	(0.3443)
Mean offer size (€ million)	115.57	117.74	113.40	4.34	-2.86
	[41.30]	[40.00]	[42.86]	(0.8846)	(0.3015)
Mean amount of 'money left on the table' (€ million)	14.63	10.41	18.85	-8.44	0.49
	[0.88]	[1.23]	[0.74]	(0.2481)	(0.2280)
Mean firm age	20.13	13.33	26.92	-13.59***	-9.90***
	[13.10]	[8.25]	[18.15]	(0.0000)	(0.0000)
Mean length of lock-up period	0.82	0.55	1.10	-0.55***	-1.00***
	[0.00]	[0.00]	[1.00]	(0.0000)	(0.0000)
Panel B: Comparison of the US Sample of VC Backed and "Matched" Non VC-backed IPOs					
Number of IPOs	1910	955	955	-	-
Percent of the full sample	*100%*	*50%*	*50%*		
Percentage of IPOs with positive initial returns	79.1%	80.6%	77.5%	-	-
Mean initial return (%)	23.75	29.15	18.32	10.83***	4.83***
	[12.92]	[15.56]	[10.73]	(0.0000)	(0.0001)
Mean offer size (€ million)	149.66	157.44	142.40	15.04	-5.16
	[93.84]	[89.72]	[94.88]	(0.4484)	(0.1171)
Mean amount of 'money left on the table' (€ million)	35.80	46.90	25.98	20.92***	6.81***
	[11.39]	[15.81]	[9.00]	(0.0000)	(0.0000)
Firm age	15.80	10.22	21.37	-11.15***	-12.79***
	[10.41]	[8.67]	[21.46]	(0.0000)	(0.0000)
Length of lock-up period	0.90	0.84	0.96	-0.12***	0.00***
	[1.00]	[1.00]	[1.00]	(0.0000)	(0.0000)

Table 4 examines that level of underpricing according to backing in Europe and in the US. Most surprisingly, after the extreme levels in 2000, initial returns stabilised and show no substantial change throughout the sub-periods. Clearly, underpricing is larger for VC-backed IPOs in both regions, which is not in favour of the certification hypothesis. Statistical t-tests, in most of the cases, present statistically significant differences between initial returns in the same IPO market cycles from both sides of the Atlantic. Finally, only in the period, from 2013 to 2015, we can find lower level of underpricing for venture-backed firms compared to non-backed ones.

Table 4: Underpricing of VC-backed IPOs by Geography

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day. Following Lee and Wahal (2004), each VC-backed IPO is matched with a non VC-backed IPO by a two-digit SIC industry classification and offer size. Amount of money left on table is calculated as the difference between the first-day closing price and offer price multiplied by offer size. Tests of differences in initial return using use a difference in means t-test and Wilcoxon rank-sum test for testing medians. Difference in offer size and amount of 'money left on the table' are also presented. Medians are in brackets. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. P-values for the statistical tests are in parentheses.

Panel A: Comparison of the US and European Sample of VC Backed IPOs

	Full Sample	EU	US	Difference in Means (p-value)	Difference in Median (p-value)
Number of IPOs	1132	175	957	-	-
Percent of the full sample	*100%*	*15.5%*	*84.5%*		
Percentage of IPOs with positive initial returns	79.2%	71.4%	80.6%	-	-
Mean initial return (%)	25.58	6.05	29.15	-23.1***	-11.56***
	[12.50]	[4.00]	[15.56]	(0.0000)	(0.0000)
Mean offer size (€ million)	151.30	117.74	157.44	39.70	-49.72***
	[85.68]	[40.00]	[89.72]	(0.3644)	(0.0000)
Mean amount of 'money left on the table' (€ million)	40.17	10.41	46.90	36.49***	-14.58***
	[10.07]	[1.23]	[15.81]	(0.0001)	(0.0000)

Panel B: Comparison of the average level of initial returns in different sub-periods (%)

	Europe		US		Difference by geography	
Year	Non VC-backed	VC-backed	Non VC-backed	VC-backed	Non VC-backed	VC-backed
2000	22.53	6.13	33.60	62.88	-11.07***	-62.75
					(0.0023)	(0.1762)
2001-2003	4.06	-	12.15	16.41	-8.09***	-
					(0.0000)	
2004-2007	-0.59	7.45	11.88	15.88	11.29***	-8.43***
					(0.0000)	(0.0002)
2008-2012	3.17	6.15	11.23	16.15	-8.06***	-10**
					(0.0000)	(0.0443)
2013-2015	4.57	2.48	15.05	24.47	-10.48***	-21.99***
					(0.0000)	(0.0001)

4.1.3 Description of Variables

Table 5 presents the descriptive statistics for each of the variables we use in the analysis of the certification theory. Clearly, the level of initial returns on average are higher in the US than in Europe, 23.75% compared to 2.11%. The amounts of 'money left on the table' also support our finding that IPOs are more underpriced in the US. As we expected, average offer size is also greater in the US, which represents its global superiority. Furthermore, ability to bring a company earlier also reflects a well-functioning stock market. In our sample, Europe lags behind the US regarding this characteristic as well. Higher average length of lock-up period from the US seems to support the above-mentioned belief, assuming that the use of lock-up period is a characteristic of superior stock markets.

Table 5: Characteristics of the Variables

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day. Amount of money left on table is calculated as the difference between the first-day closing price and offer price multiplied by offer size. Offer size is the offering amount in € millions.

Variable	Symbol	Mean	Median	Max.	Min.	Std. Dev.	Obs.
Panel A: European Sample							
Initial return (%)	UP	2.11	3.66	95.71	-98.92	26.48	350
Amount of 'money left on the table'	MONEY	14.63	0.88	723.40	-86.03	68.26	350
Type of backing	TYPE	-	-	-	-	-	350
Offer size	SIZE	115.57	41.30	3,328.23	5.00	278.70	350
Age of IPO firm (year)	AGE	20.13	13.08	216.00	0.08	22.78	350
Number of IPOs	NUMBERIPO	134.15	151.00	338.00	9.00	56.12	350
Hot market period	MARKET	-	-	-	-	-	350
Length of lock-up period (in 180 days)	LOCKUP	0.83	0.00	6.00	0.00	0.99	350
Panel B: US Sample							
Initial return (%)	UP	23.75	12.92	273.08	-29.55	38.21	1910
Amount of 'money left on the table'	MONEY	35.80	11.39	1,540.77	-67.19	100.54	1910
Type of backing	TYPE	-	-	-	-	-	1910
Offer size	SIZE	149.62	93.84	16,006.88	5.78	416.05	1910
Age of IPO firm (year)	AGE	15.80	10.41	103.58	0.17	12.92	1910
Number of IPOs	NUMBERIPO	112.68	91.00	228.00	9.00	64.43	1910
Hot market period	MARKET	-	-	-	-	-	1910
Length of lock-up period (in 180 days)	LOCKUP	0.90	1.00	4.00	0.00	0.35	1910

Table 6 presents the descriptive statistics for each of the variables we use in the analysis of the grandstanding hypothesis. Most important, the indicators of underpricing, namely, initial returns and amount of 'money left on the table' of VC-backed IPOs are at a higher

level on average in the US than are in Europe. Furthermore, European venture-backed firms seem to go public with lower firm age and after fewer financing rounds, based on sample means and medians. As we expected, offer size, length of lock-up period, number of funds, and capital under management are all greater in the US, which represents a superior venture capital industry.

Table 6: Characteristics of the Variables

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day. Amount of money left on table is calculated as the difference between the first-day closing price and offer price multiplied by offer size. Offer size is the offering amount in € millions.

Variable	Symbol	Mean	Median	Max.	Min.	Std. Dev.	Obs.
Panel A: European Sample							
Initial return (%)	UP	6.05	4.00	40.32	-16.00	11.27	175
Amount of 'money left on the table'	MONEY	10.41	1.20	346.70	-86.00	36.22	175
Age of IPO firm (year)	AGE	13.33	8.25	216.00	0.08	20.83	175
Time to exit	EXITTIME	5.07	4.90	17.80	0.00	3.02	175
Number of rounds	ROUND	3.63	3.60	10.00	1.00	2.24	175
Underwriter rank	RANK	0.34	0.20	1.00	0.00	0.31	175
Number of funds	FUNDS	3.62	3.00	9.00	1.00	2.41	175
Offer size	SIZE	117.74	40.00	3,328.23	5.00	309.82	175
Capital under management	FUNDSIZE	373.75	300.00	8,447.04	5.87	272.28	175
Length of lock-up period (in 180 days)	LOCKUP	0.55	0.00	3.00	0.00	0.88	175
Number of IPOs	NUMBERIPO	129.41	151.00	338.00	9.00	55.56	175
Hot market period	MARKET	-	-	-	-	-	175
Panel B: US Sample							
Initial return (%)	UP	29.18	15.56	273.08	-29.55	46.45	955
Amount of 'money left on the table'	MONEY	45.63	14.94	1,540.77	-67.19	113.98	955
Age of IPO firm (year)	AGE	10.22	8.67	103.58	0.17	11.26	955
Time to exit	EXITTIME	5.87	5.00	31.10	0.20	3.87	955
Number of rounds	ROUND	4.76	4.75	10.00	1.00	2.44	955
Underwriter rank	RANK	5.81	6.61	9.20	0.00	3.60	955
Number of funds	FUNDS	6.57	6.00	33.00	1.00	4.01	955
Offer size	SIZE	156.83	89.72	16,006.88	5.78	554.20	955
Capital under management	FUNDSIZE	555.58	562.50	25,880.00	50.00	174.70	955
Length of lock-up period (in 180 days)	LOCKUP	0.84	1.00	4.00	0.00	0.44	955
Number of IPOs	NUMBERIPO	132.78	118.00	225.00	16.00	59.69	955
Hot market period	MARKET	-	-	-	-	-	955

4.2 Methodology

As most of the researchers, we are going to analyse underpricing as the difference between the offer price and the stock price at the end of the first trading day which is a standard event study methodology. Additionally, we measure underpricing by the amount of 'money left on the table'.

4.2.1 Underpricing

Using underpricing as a measure of the economic role of venture backing, it is assumed implicitly that the closing price at the end of the first trading day is equal to the true value of the equity.[1]

A common way to measure underpricing is to compute the difference between the offer price and the first-day closing price of the stock. One of the greatest disagreements among academics is the way one calculates the first day returns. Closing prices, bid prices, and bid-ask average price are found as valid methods. In our empirical analysis, we calculate the return of an investor who could buy share in the primary market and sells those shares at the end of the first trading day. Thus, underpricing for public listing can be calculated as the percentage change from the offer price $P_{i,OP}$ to the closing price $P_{i,CP}$ (Bessler and Seim, 2011):

$$UP_i = \frac{P_{i,CP} - P_{i,OP}}{P_{i,OP}}. \qquad (5.1)$$

The real loss in underpricing for the VC is that it transfers wealth from old shareholders to new ones. Alternatively, these costs related to IPOs can also be measured by calculating the incremental amount of 'money left on the table' in IPOs. Consistent with Loughran and Ritter (2002) we calculate this amount as the number of shares issued multiplied by the difference between the closing price of the first trading day and the offer price.

[1] There are studies (Purnanandam and Swaminathan, 2004; Ritter, 1991; Morris, 1996; Duffle, Garleanu and Pedersen, 2002) that argue that this assumption might be violated while analysing underpricing because this price level shows overpricing and reflects mainly valuations of the most optimistic investors. However, in our study we assume that the closing price reflects the intrinsic value of the equity.

Thus, amount of 'money left on table' for an IPO can be calculated as follows:

$$\mathrm{MONEY_i} = (\mathrm{P_{i,CP}} - \mathrm{P_{i,OP}}) \times N_{i,Shares} \qquad (5.2)$$

, where $\mathrm{P_{i,OP}}$ and $\mathrm{P_{i,CP}}$ represent the offer price and closing price for the given share, respectively. $\mathrm{N_{i,\ Shares}}$ represent the total number of shares issued.

Lerner (1994) and Ritter (1984) argue that equity issuing activities are volatile and, thus, hot and cold periods can be observed, where hot issue periods are described by high and ever increasing stock prices and a large and rising number of primary offers. On the other hand, cold issue periods are characterised by relatively low stock prices and less number of IPOs. Consequently, the equity issuing activity creates windows of opportunities. Yung, Colak, and Wang (2008) document that positive shocks to the economy raises overall growth projections, equity valuations and investor sentiment. As a result, low-quality firms have the chances to go public with numerous good-quality firms. Hence, hot equity issue periods offer ideal opportunity to venture capitalists to exit from high- and low-quality firms as well.

Ball et al. (2011) find that VC tend to take portfolio companies public when markets are high and turn to other exit routes when markets are falling. This phenomenon is called market timing, namely that issuers exploit hot market environment. Since this market behaviour raises adverse selection issues and uncertainty regarding the true value of the IPO candidate, issuing firms might be forced to accept higher level of underpricing. Moreover, underpricing seems to be larger during hot periods which, in turn, incentivise sponsors to exit at a later time.

Lerner (1994) suggests that several factors can affect VCs decision when to bring firms public. One of these is the valuation level of publicly traded firms. The research shows that VC try to take firms public when valuations are high, and that experienced venture capitalists appear to be better at timing IPOs.

Bessler and Seim (2011) argue that the success of an IPO not only depends on firm´s intrinsic value but size, liquidity, and quality of the given equity market.

Bessler and Kurth (2007) also find that market environments, i.e. hot or cold periods, can also influences price performance.

Welch (1989) argues that a high level of undepricing of IPOs, which may be easier to carry out in hot market environments, might be seen as a positive act from the investors' view.

Therefore, consistent with Welch (1989), Ritter and Welch (2002), and Loughran and Ritter (2002), we examine the underpricing differential over more sub-periods due to non-stationarity and whether hot market environment affects the level of underpricing.

4.2.2 Certification Hypothesis

The implication of the certification hypothesis is that the level of underpricing should be less for VC-backed IPOs than non VC-backed ones. That is, if venture capitalists are able to mitigate information asymmetry, the level of compensation that external investors require should be lower.

Consistent with Megginson and Weiss (1991), our basic empirical model looks as follows:

$$UP_i = C + \beta_1 TYPE + \beta_2 LOGSIZE + \beta_3 AGE + \beta_4 NUMBERIPO + \beta_5 MARKET + \beta_6 LOCKUP + \epsilon_i \quad (5.3)$$

, where *i* refers to the IPO, *C* to the constant term, and ε is the error term.

We study the relationship of initial returns and amount of 'money left on the table' to the following variables:

i. A dummy variable (TYPE) for whether the IPO is VC-backed. The level of underpricing should be lower for VC-backed offers (TYPE=1) than for non VC-backed offers (TYPE=0). Therefore, we expect negative relation between the dummy variable and the dependent variables.
ii. The natural log of the offering amount (LOGSIZE). Ritter (1984) document that initial returns are significantly related to offering size. With this variable we

control for size. From the certification theory's view, the coefficient of this variable should be negative and insignificant.

iii. The age of the firm (AGE). It works as a control for the degree of information asymmetry. Similar to Megginson and Weiss (1991) we expect a negative relationship between initial returns and age, which implies that older firms are associated with lower level of information asymmetry. We define company age as the time between the incorporation date of the IPO firm and the date of the IPO.

iv. The total number of IPOs in the year of the given IPO (NUMBERIPO). The total number of listings can be an accurate proxy of the IPO market's activity in the given year. With this variable we control for the change in IPO market activity.

v. The time span of our sample is 2000 to 2015 which includes two market cycles based on our analysis. We consider the time intervals 2004-2007 and 2013-2015 as hot market periods, which might have caused structural changes to our model. Therefore, in order to have deeper insight on the behaviour of the model in these specific periods, and to test for the significance of the changes brought by the hot market periods, we introduce a dummy variable (MARKET). Hence, MARKET assumes a value of 1 from 2004 until 2007 or from 2013 until 2015 and zero otherwise.

vi. The length of the lock-up period (LOCKUP). Lock-up periods are normally required by investment banks to signal quality and commitment. They further prolong the investment period of a VC, which can work as a counterforce to underpricing. Hence, we expect negative and significant relationship. Lock-up period is normally defined in days but most of the time they represent a half or one year. Therefore, we introduce a unit measure in which 180 days represent one unit.

As we explained above, there is strong evidence that cyclical movement of the IPO market can cause structural changes, thus, influencing the pricing of listings. Therefore, in order to obtain a profound insight how hot market periods might change the behaviour of market participants, we create interaction variables with the help of the dummy variable

MARKET. By introducing these new variables, we are able to estimate the coefficients for all the explanatory variables in the hot market periods.
Similarly, we analyse the structural changes that VC backing might bring to IPOs. Therefore, we introduce new interaction variables using the dummy variable TYPE.

Hence, our model changes as follows:

$$UP_i = C + \beta_1 TYPE + \beta_2 LOGSIZE + \beta_3 AGE + \beta_4 NUMBERIPO + \beta_5 MARKET + \beta_6\, LOCKUP + \beta_7 TYPE * MARKET + \beta_8 LOGSIZE * MARKET + \beta_9 AGE * MARKET + \beta_{10} NUMBERIPO * MARKET + \beta_{11}\, LOCKUP * MARKET + \epsilon_i \qquad (5.4)$$

$$UP_i = C + \beta_1 TYPE + \beta_2 LOGSIZE + \beta_3 AGE + \beta_4 NUMBERIPO + \beta_5 MARKET + \beta_6\, LOCKUP + \beta_7 LOGSIZE * TYPE + \beta_8 AGE * TYPE + \beta_9 NUMBERIPO * TYPE + \beta_{10} MARKET * TYPE + \beta_{11}\, LOCKUP * TYPE + \epsilon_i \qquad (5.5)$$

Tests of the certification hypothesis are presented in the next chapter.

4.2.3 Grandstanding Hypothesis

We hypothesise that VCs have different abilities to select or create portfolio companies that have high chances to go public. As we stated before, they can signal their ability most effectively by successfully exiting, i.e., taking portfolio companies public.
If there is a common belief that high-ability venture capitalists are more likely to nurture potential IPO candidates, then undertaking flotation can be interpreted as a sign of having the ability to finance high potential ventures. Additionally, a successful IPO by a young VC can affect external investors' belief in a positive way more than for a more established VC. Old venture capitalists do not need to signal ability since they showed evidence over many years (Lee and Wahal, 2004).
In sum, each additional IPO undertaken by a young VC attracts more capital for it than it does for older VCs. Thus, old VCs do not rush to raise new funds subsequent to public listings. All of these hypotheses are consistent with industry wisdom. Muscarella and

Vetsuypens (1989) also document that older the firm is at public listing, the lower is the return on the first trading day.

From these reasons, we believe that young venture capital firms tend to have shorter relationship with their portfolio companies which have been taken public.

Our basic empirical model looks as follows[2]:

$$MONEY_i = C + \beta_1 AGE + \beta_2 EXITTIME + \beta_3 ROUNDS + \beta_4 RANK + \beta_5 FUNDS + \beta_6\, SIZE + \beta_7\, FUNDSIZE + \beta_8\, LOCKUP + \beta_9 IPOS + \beta_{10} MARKET + \beta_{11}(RANK + SMALL) + \beta_{12}(SIZE + SMALL) + \epsilon_i \quad (5.6)$$

, where *i* refers to the IPO, *C* to the constant term, and ε is the error term.

Consistent with Lee and Wahal (2004), we study the relationship of initial returns and amount of 'money left on the table' to the following variables[3]:

i. The average capital under management of venture capital firms (FUNDSIZE). We believe this variable is a robust proxy for VC's reputation. Thus, this variable is our primary explanatory variable, since the grandstanding hypothesis asserts that VCs with less experience, i.e. with less reputation, underprice IPOs in order to become associated with successful exits. Hence, they are able to raise more capital for their subsequent funds. We anticipate negative and significant relation to the dependent variables.

ii. A dummy variable that controls for VC reputation (SMALL). It represents IPOs, where the average capital under management of all the venture capital firms involved in a given IPO is below €300 million and $400 million in Europe and in the US, respectively. With this explanatory dummy variable, we measure whether there is any difference regarding underpricing between venture capitalists with low and high reputation. We believe there is a need to separate VCs with two different limits for these two regions due to the relative market size difference.

[2] The explanatory variables SIZE and FUNDS, and ROUNDS and FUNDS for the European sample are moderately correlated, 0.39 and 0.34, respectively. Therefore, we present them together in the equation only for illustration purposes.

[3] Explanatory variables introduced in the previous sub-chapter are not listed here, even though they are used in testing the grandstanding hypothesis.

iii. The time to IPO (EXITTIME). We define exit time to IPO as the time span between the date of the first investment received by the portfolio company and its IPO. Since information asymmetry may be higher for portfolio companies taken public at their earlier development stage, we expect negative relation to the dependent variables.

iv. The number of financial rounds before the IPO (ROUNDS). Introducing this variable, we intend to further measure the possible role of information asymmetry in venture-backed public listings. We conjecture that more financial rounds might be a proxy for quality, since raising venture capital is relatively difficult due to the thorough due diligence of VCs. We anticipate a negative relationship as well.

v. The number of venture capital funds backing the IPO firm (FUNDS). The reasoning and our expectation regarding this variable are similar to the previous one.

vi. The quality of underwriter (RANK). Following Gompers (1996) we also include underwriter rank as a control variable. With the help of this variable we separate the effect of venture capital backing from the quality of the underwriter. For the European sample we use the ranking list created by Migliorati and Vismara (2014). The US underwriter rankings are based on the wide-spread Carter-Manaster (1990) ranking. They range in value from 0 to 1 and 0 to 9, respectively, with higher values indicating higher quality rankings. We expect that underwriter quality certify the IPOs as well, thus, we expect negative relation to initial returns.

vii. As we previously mentioned, the grandstanding hypothesis asserts that less established venture capital firms might be associated with higher level of underpricing since they benefit relatively more from such an undertaking than well-established counterparts. Therefore, we include interaction variables to measure any characteristics that could be associated only with low-reputation VCs (RANK+SMALL, and SIZE+SMALL).

Therefore, to test the grandstanding hypothesis, we divide the VC-backed IPOs into two groups with respect to the venture capitalists' asset size. As we stated before, we download information on venture capital firms from the database Thomson ONE. The first group consists of IPOs backed by venture capital firms with less experience,

meanwhile, the second group includes the well-established VCs. In contrast to Gompers (1996), we use the total amount of capital managed as a proxy for reputation instead of firm age. We argue that capital under management is also an effective proxy for reputation because reputational effects should be captured by it. The more capital is under management, the better the venture capital firm is in fundraising.

IPOs are classified as less experienced with an average amount of capital under management below €300 million/$400 million and as more experienced with larger than €300 million/$400 million.

As a firm approaches IPO, it must hire at least one underwriter to manage certain tasks related to this event, such certifying prospectus and other filing documents, and raising visibility and interest among investors in a "road show". Megginson and Weiss (1991) assert that it is possible that VCs have built relationships with underwriters in the past due to previous involvement of public listings. Consequently, VCs should attract higher quality underwriters which further lower the cost of due diligence, protect VCs' reputational capital and provide them with increased access to institutional investors. Similar to their findings we also find that VC-backed IPOs are accompanied by underwriters with higher ranking than non VC-backed offers.

Table 7 presents summary information for the IPOs backed by well-established and less experienced VCs. Most important, less-experienced VCs raise subsequent funds significantly faster post-IPO (an average of 17.01 months after IPO and average of 19.10 months, respectively). However, this difference in the US is not statistically significant. The average time to exit and the average firm age further support the grandstanding hypothesis. Furthermore, less experienced venture capital firms bring to market IPOs that are more underpriced. The average initial return is 7.82% for IPOs backed by smaller VCs versus 4.82% for larger ones. As expected, experienced venture capital firms tend to use higher-quality underwriters both in Europe and in the US since they may have built strong relationships with established underwriters through previous IPOs.

In sum, these summary statistics are consistent with the grandstanding hypothesis. Smaller VCs take portfolio companies public earlier and bear the cost of greater underpricing.

Table 7: Characteristics of IPOs backed by experienced and less-experienced VC firms

Sample is 175 and 956 venture backed listings from Europe and from the US, respectively. *P*-values of significance tests for differences in averages are in parentheses. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%.

	Below €300m/$400m under management on average		300m/$400m or more under management on average		Difference (p-value)	
	Europe	US	Europe	US	Europe	US
Average time from IPO date to next follow-on fund in months	17.01	17.61	19.10	18.35	-2.09 (0.1156)	-0.74*** (0.0000)
Average initial return at the IPO date	7.82	41.05	4.82	22.26	3.00 (0.2456)	18.79 (0.6793)
Average amount of 'money left on the table'	42.83	67.07	94.69	33.11	-51.86 (0.9119)	33.96 (0.8991)
Average offering size in millions	116.39	157.97	118.69	156.17	-2.3*** (0.0001)	1.8*** (0.0000)
Average underwriter rank	0.30	6.21	0.38	5.50	-0.08*** (0.0002)	0.71 (0.2023)
Average time to exit in years	5.19	5.87	5.06	5.88	0.13*** (0.0010)	-0.01*** (0.0000)
Average age of issuing firm at IPO date in years	12.36	10.13	14.02	10.28	-1.66 (0.1563)	-0.15*** (0.0003)
Average number of financing rounds prior IPO	3.94	4.8	3.41	4.73	0.53*** (0.0019)	0.007*** (0.0000)
Average number of VC funds involved	4.08	6.52	3.30	7.65	0.78*** (0.0000)	-1.13*** (0.0000)
Average amount of accumulated investment prior IPO in millions	69.06	150.27	31.71	111.46	37.35 (0.2677)	38.81 (0.3552)
Average length of lock-up period in 180 days	0.6	0.81	0.52	0.85	0.08 (0.1256)	-0.04* (0.0885)
Number	72	353	103	603	-	-

Tests of the grandstanding hypothesis are presented in the next chapter.

5 Empirical Results and Analysis

In our empirical analysis, we investigate the level of the underpricing and its relation to other factors. In section 6.1 and 6.2, we study whether the two main hypotheses are supported by the short-term performance characteristics of VC-backed and non VC-backed IPOs.

5.1 Certification Hypothesis

The testable implications of the certification hypothesis are that the level of underpricing and the amount of offer size and the age of IPO firm will be less for VC-backed firms than non VC-backed entities. As we introduced in earlier sections, venture capitalists might be able to reduce information asymmetry.

5.1.1 The European IPO Market

Table 8 provides evidence against the above-mentioned hypothesis. Initial returns are calculated as the percentage change between offer price and first-day closing price.

Table 8: European Initial Returns of the Matched Sample

Multivariate Tests

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day. Following Lee and Wahal (2004), each VC-backed IPO is matched with a non VC-backed IPO with the same 2-digit SIC industry code and with the closest offer size. The dummy variable TYPE shows whether the IPO is VC-backed (VC-backed = 1, non VC-backed = 0). LOGSIZE explanatory variable is the natural log of offer size in € million. Firm age is calculated as the time span between foundation and IPO date in years. The dummy variable MARKET shows whether a given IPO has taken place in the time intervals either 2004-2007 or 2013-2015. Lock-up periods are calculated as units where one unit reflects 180 days. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. Standard deviations are presented in brackets. In regression (6) and (7) first we show the coefficients of the variables and then below we present the coefficients of the interaction variables created with the help of dummy variables MARKET and TYPE, respectively.

	Dependent variable: Initial return						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	-12.52**	-8.93*	-12.43**	-12.19**	-7.24	-10.20	-4.42
	[5.077]	[5.302]	[6.091]	[6.181]	[6.177]	[8.225]	[9.591]
TYPE	8.20***	6.28**	6.54**	6.49**	3.53	5.79	2.05
	[2.790]	[2.906]	[2.913]	[2.924]	[2.958]	[4.497]	[12.039]
TYPE+MARKET	-	-	-	-	-	1.71	-
						[6.140]	
LOGSIZE	2.73**	2.79**	2.65**	2.64**	3.04**	3.69**	2.72
	[1.195]	[1.189]	[1.194]	[1.197]	[1.176]	[1.615]	[1.768]
LOGSIZE+MARKET	-	-	-	-	-	-0.61	-
						[2.364]	
LOGSIZE+TYPE	-	-	-	-	-	-	-0.57
							[2.423]
AGE	-	-0.14**	-0.14**	-0.14**	-0.13**	-0.15	-0.23***
		[0.064]	[0.064]	[0.064]	[0.063]	[0.104]	[0.086]
AGE+MARKET	-	-	-	-	-	0.05	-
						[0.130]	
AGE+TYPE	-	-	-	-	-	-	0.24*
							[0.127]
NUMBERIPO	-	-	0.03	0.03	0.03	0.05*	0.04
			[0.025]	[0.026]	[0.025]	[0.028]	[0.034]
NUMBERIPO+MARKET+TYPE	-	-	-	-	-	-0.18**	-
						[0.073]	
NUMBERIPO	-	-	-	-	-	-	-0.03
							[0.052]
MARKET	-	-	-	-0.70	0.09	19.45	2.63
				[2.912]	[2.858]	[15.070]	[4.145]
MARKET+TYPE	-	-	-	-	-	-	-2.34
							[5.932]
LOCKUP	-	-	-	-	-5.69***	-10.76***	-8.23***
					[1.427]	[2.150]	[1.936]
LOCKUP+MARKET	-	-	-	-	-	8.66***	-
						[2.954]	
LOCKUP+TYPE	-	-	-	-	-	-	5.88*
							[3.035]
R-squared	0.036	0.050	0.054	0.054	0.096	0.137	0.117
Adj. R-squared	0.031	0.042	0.043	0.040	0.080	0.109	0.088
F-statistic	6.612	6.100	4.918	3.936	6.072	4.891	4.075
Prob. (F-statistic)	0.002	0.001	0.001	0.002	0.000	0.000	0.000

The results in Table 8 seem to support the inverse of value certification hypothesis. In all equations, the coefficient associated to the dummy variable TYPE is either positive and significant or not statistically significant, when lock-up period variable is included (5 to 8). Surprisingly, the offer size is positive and statistically significant which indicates that size of IPO deals heightens underpricing, which contrasts our expectations. The coefficient means that each additional percentage increase in offer size translates into roughly 3 percentage point change in initial return.

Similar to Muscarella and Vetsuypens (1989), we also find that there is a statistically significant relationship between the age of the IPO firm and its initial return. This phenomenon exists, supposedly, due to the higher amount of information available on older companies. We find that this effect is almost twice as much stronger for venture-backed IPOs than for other ones, although size of the effect is considerably small. Furthermore, the variable that controls for the number of IPOs in a year (NUMBERIPO) is not significant, except during hot market periods when it reduces underpricing. The dummy variable MARKET, which controls for the IPOs that had occurred in the periods 2004-2007 and 2013-2015, is also not significant. Finally, the coefficient associated to the length of the lock-up period (LOCKUP) is negative and statistically significant which confirms the existing signalling effect of lock-up periods. Surprisingly, among VC-backed IPOs lock-up periods seem to have reverse effect which is contrast academic literature and wisdom.

We also regress the same model using as dependent variable the amount of 'money left on the table'. Since the correlation between initial returns and amount of 'money left on the table' are low[4], we believe using another dependent variable makes our analysis more robust. Table 9 presents the results of these regressions. Most interestingly, the coefficient associated to VC-backed IPO (TYPE) is negative, although statistically significant only in equations 5 and 6, which suggests that VC investors leave less money on the table than do non-VC investors. Furthermore, offer size is significant at conventional levels in this case as well. Moreover, the variable AGE has exactly the same effect on our alternative dependent variable as we find in the previous regressions, which confirms the hypothesis that old firm face lower asymmetric information problems. Surprisingly, the coefficient

[4] Correlations in Europe and in the US are 0.36 and 0.14, respectively.

associated to the variable NUMBERIPO is positive and statistically significant in this case which has the implication that underpricing tend to be higher in years with more IPOs. Finally, the coefficients of variables MARKET and LOCKUP are negative and significant. The negative sign of the former variable contrast the academic literature since initial returns tend to rise during hot market periods.

Table 9: Amount of 'money left on the table' of the European Matched Sample Multivariate Tests

Amount of 'money left on the table' is calculated as the price difference between offer price and first-day closing price of the stock multiplied by the number of shares issued. Following Lee and Wahal (2004), each VC-backed IPO is matched with a non VC-backed IPO with the same 2-digit SIC industry code and with the closest offer size. The dummy variable TYPE shows whether the IPO is VC-backed (VC-backed = 1, non VC-backed = 0). LOGSIZE explanatory variable is the natural log of offer size in € million. Firm age is calculated as the time span between foundation and IPO date in years. The dummy variable MARKET shows whether a given IPO has taken place in the time intervals either 2004-2007 or 2013-2015. Lock-up periods are calculated as units where one unit reflects 180 days. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. Standard deviations are presented in brackets. In regression (6) and (7) first we show the coefficients of the variables and then we present the coefficients of the interaction variables created with the help of dummy variables MARKET and TYPE, respectively.

Dependent variable: Amount of 'money left on the table'							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	-47.78***	-40.92***	-65.21***	-56.58***	-51.13***	-57.35***	-66.18***
	[12.734]	[13.336]	[15.122]	[15.073]	[15.339]	[20.606]	[23.566]
TYPE	-6.44	-10.10	-8.30	-10.06	-13.33*	-24.83**	24.80
	[6.996]	[7.309]	[7.231]	[7.130]	[7.344]	[11.266]	[29.582]
TYPE+MARKET	-	-	-	-	-	22.38	-
						[15.376]	
LOGSIZE	17.02***	17.13***	16.19***	15.68***	16.13***	21.90***	16.28***
	[2.997]	[2.990]	[2.964]	[2.919]	[2.920]	[4.047]	[4.345]
LOGSIZE+MARKET	-	-	-	-	-	-13.65**	-
						[5.923]	
LOGSIZE+MARKET	-	-	-	-	-	-	-1.83
							[5.953]
AGE	-	-0.27*	-0.27*	-0.25	-0.24	-0.58**	-0.37*
		[0.161]	[0.158]	[0.156]	[0.155]	[0.259]	[0.212]
AGE+MARKET	-	-	-	-	-	0.59*	-
						[0.326]	
AGE+TYPE	-	-	-	-	-	-	0.41
							[0.314]
NUMBERIPO	-	-	0.20***	0.26***	0.25***	0.23***	0.43***
			[0.062]	[0.063]	[0.063]	[0.069]	[0.085]
NUMBERIPO+MARKET	-	-	-	-	-	-0.14	-
						[0.183]	
NUMBERIPO+TYPE	-	-	-	-	-	-	-0.43***
							[0.127]
MARKET	-	-	-	-25.17***	-24.29***	24.70	-32.26***
				[7.101]	[7.096]	[37.757]	[10.186]
MARKET+TYPE	-	-	-	-	-	-	26.07*
							[14.576]
LOCKUP	-	-	-	-	-6.27*	-7.93	-8.40*
					[3.545]	[5.388]	[4.758]
LOCKUP+MARKET	-	-	-	-	-	2.17	-
						[7.400]	
LOCKUP+TPYE	-	-	-	-	-	-	5.83
							[7.456]

R-squared	0.088	0.096	0.123	0.154	0.161	0.185	0.198
Adj. R-squared	0.083	0.088	0.113	0.141	0.147	0.159	0.172
F-statistic	16.845	12.235	12.082	12.502	11.004	6.993	7.592
Prob. (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Since in regression (6) and (7) the examined dummy variables are not significant neither hot market periods nor VC backing bring structural change into the model. The F-statistics reject the null hypothesis of insignificance in all of the regression, hence, the presented variables can jointly predict level of underpricing in our sample of European IPOs.

The results of the two previous sections present a similar picture of the European IPO market. However, in case of our primary explanatory variable we find contradictive results which make the results slightly inconsistent. We document that (1) venture capitalists do not certify the offer, which give rise to underpricing, but that they leave less money on the table as they should sell less shares in IPOs; (2) offer size pushes initial returns higher; (3) age of issuing firm and (4) length of lock-up period lowers underpricing; (5) number of IPOs in the year of a given IPO increases underpricing; and (6) hot market periods affect initial returns negatively.

5.1.2 The US IPO Market

This section examines the US IPO market and the possible drivers of underpricing. Similar to the previous section, Table 10 shows the initial return as dependent variable and the same explanatory variables. Similar to the results from the underpricing analysis in Table 2, we document that the dummy variable TYPE is positive and statistically significant. This finding contrast with the results what Megginson and Weiss (1991) report along with the certification hypothesis as well. The size of the offering (LOGSIZE) is positive and significant at 5% level in all of the regressions. Firm age shows the same coefficient characteristics as they do in the previous tables, namely, age reduces underpricing, especially in VC-backed IPOs. Hence, we can state with certainty that firm age has significant effect on initial return in both regions. On the one hand, we find that the coefficient of the yearly number of IPOs is positive and significant. On the other hand, we also document that in hot market periods initial returns are being lowered. Similar to the European market, lock-up period has a negative and significant effect on underpricing.

Moreover, we find that lock-up periods have stronger effect, more the two times, on VC-backed listings than they have on non-backed ones.

We find the interaction regressions insignificant in this case as well based on the dummy variables. The explanatory variables are jointly significant in the US as well.

Table 10: Initial Returns of the US Matched Sample

Multivariate Tests

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day. Following Lee and Wahal (2004), each VC-backed IPO is matched with a non VC-backed IPO with the same 2-digit SIC industry code and with the closest offer size. The dummy variable TYPE shows whether the IPO is VC-backed (VC-backed = 1, non VC-backed = 0). LOGSIZE explanatory variable is the natural log of offer size in USD millions. Firm age is calculated as the time span between foundation and IPO date in years. The dummy variable MARKET shows whether a given IPO has taken place in the time intervals either 2004-2007 or 2013-2015. Lock-up periods are calculated as units where one unit reflects 180 days. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. Standard deviations are presented in brackets. In regression (6) and (7) first we show the coefficients of the variables and then we present the coefficients of the interaction variables created with the help of dummy variables MARKET and TYPE, respectively.

	Dependent variable: Initial return						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	-17.69***	-13.88**	-46.97***	-40.11***	-31.21***	-25.83***	-25.73***
	[5.368]	[5.474]	[5.499]	[5.546]	[6.336]	[7.914]	[9.776]
TYPE	11.20***	8.48	13.47***	12.63***	11.52***	8.38***	-13.29
	[1.711]	[1.891]	[1.795]	[1.781]	[1.819]	[2.296]	[12.600]
TYPE+MARKET	-	-	-	-	-	6.48	-
						[6.238]	
LOGSIZE	7.80***	8.11***	9.30***	8.82***	8.72***	9.52***	4.64***
	[1.133]	[1.134]	[1.06]	[1.055]	[1.053]	[1.326]	[1.532]
LOGSIZE+MARKET	-	-	-	-	-	-2.82	-
						[2.178]	
LOGSIZE+TYPE	-	-	-	-	-	-	7.87***
							[2.109]
AGE	-	-0.25***	-0.14**	-0.13*	-0.13*	-0.11	0.04
		[0.073]	[0.069]	[0.068]	[0.068]	[0.087]	[0.092]
AGE+MARKET	-	-	-	-	-	-0.03	-
						[0.140]	
AGE+TYPE	-	-	-	-	-	-	-0.37***
							[0.137]
NUMBERIPO	-	-	0.21***	0.20***	0.19***	0.18***	0.13***
			[0.013]	[0.012]	[0.013]	[0.014]	[0.021]
						0.031	
						[0.094]	
							0.09***
							[0.027]
MARKET	-	-	-	-10.67***	-10.19***	-23.61	-10.83***
				[1.662]	[1.667]	[17.447]	[2.327]
MARKET+TYPE	-	-	-	-	-	-	5.03
							[3.398]
LOCKUP	-	-	-	-	-7.28***	-15.27***	10.51**
					[2.522]	[3.154]	[5.876]
LOCKUP+MARKET	-	-	-	-	-	21.71***	-
						[5.375]	
LOCKUP+TYPE	-	-	-	-	-		-18.72***
							[6.563]
R-squared	0.044	0.050	0.169	0.186	0.190	0.199	0.208
Adj. R-squared	0.043	0.048	0.167	0.184	0.187	0.194	0.203
F-statistic	43.863	33.110	96.627	87.169	74.309	42.733	45.241
Prob. (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 11 presents the same regressions with the amount of ‘money left on the table’ as dependent variable. Venture-backing has the same effect on the dependent variable as we find in the previous regressions, as the coefficient associated to this variable is positive and significant in all but the last regression. In regression (7) the dummy variable TYPE is significant this time, which implies that venture capital backing brings structural change into our model. We report positive and significant coefficient for the variable LOGSIZE. Furthermore, firm age shows similar characteristics what we find in the previous regressions and so do the variables NUMBERIPO, MARKET and LOCKUP. However, in this case, variables for length of lock-up period, number of IPOs, and hot market periods are not significant when analysing the interaction effect of venture capital involvement.

Table 11: Amount of 'money left on the table' of the US Matched Samples Multivariate Tests

Amount of 'money left on the table' is calculated as the price difference between offer price and first-day closing price of the stock multiplied by the number of shares issued. Following Lee and Wahal (2004), each VC-backed IPO is matched with a non VC-backed IPO with the same 2-digit SIC industry code and with the closest offer size. The dummy variable TYPE shows whether the IPO is VC-backed (VC-backed = 1, non VC-backed = 0). LOGSIZE explanatory variable is the natural log of offer size in USD millions. Firm age is calculated as the time span between foundation and IPO date in years. The dummy variable MARKET shows whether a given IPO has taken place in the time intervals either 2004-2007 or 2013-2015. Lock-up periods are calculated as units where one unit reflects 180 days. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. Standard deviations are presented in brackets. In regression (6) and (7) first we show the coefficients of the variables and then we present the coefficients of the interaction variables created with the help of dummy variables MARKET and TYPE, respectively.

Dependent variable: Amount of 'money left on the table'							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	-217.93*** [13.186]	-206.36*** [13.425]	-259.49*** [14.027]	-251.81*** [14.269]	-235.34*** [16.319]	-287.12*** [20.227]	-196.53*** [25.273]
TYPE	21.92*** [4.203]	13.66*** [4.638]	21.68*** [4.578]	20.74*** [4.583]	18.68*** [4.685]	12.40** [5.869]	-73.23** [32.573]
TYPE+MARKET	-	-	-	-	-	9.56 [15.943]	-
LOGSIZE	52.83*** [2.783]	53.77*** [2.780]	55.68*** [2.712]	55.14*** [2.714]	54.96*** [2.713]	68.57*** [3.390]	42.14*** [3.960]
LOGSIZE+MARKET	-	-	-	-	-	-36.99 [5.566]	-
LOGSIZE+TYPE	-	-	-	-	-	-	25.12 [5.452]
AGE	-	-0.74*** [0.180]	-0.57*** [0.176]	-0.57*** [0.176]	-0.56*** [0.176]	-0.77*** [0.222]	-0.21 [0.238]
AGE+MARKET	-	-	-	-	-	0.50 [0.357]	-
AGE+TYPE	-	-	-	-	-	-	-0.92*** [0.354]
NUMBERIPO	-	-	0.33*** [0.032]	0.33*** [0.032]	0.30*** [0.034]	0.31*** 0.035	0.28*** 0.055
NUMBERIPO+MARKET	-	-	-	-	-	-0.10 [0.241]	-
NUMBERIPO+TYPE	-	-	-	-	-	-	0.03 [0.071]
MARKET	-	-	-	-11.94*** [4.277]	-11.06** [4.294]	134.15*** [44.591]	-16.05*** [6.015]
MARKET+TYPE	-	-	-	-	-	-	12.21 [8.785]
LOCKUP	-	-	-	-	-13.48** [6.497]	-20.48** [8.060]	4.38 [15.191]
LOCKUP+MARKET	-	-	-	-	-	23.69* [13.737]	-
LOCKUP+TYPE	-	-	-	-	-	-	-19.01 [16.967]
R-squared	0.167	0.174	0.219	0.222	0.224	0.244	0.235
Adj. R-squared	0.166	0.173	0.217	0.220	0.221	0.239	0.231
F-statistic	191.178	134.218	133.363	108.632	91.401	55.633	53.082
Prob. (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

5.2 Grandstanding Hypothesis

In this section, we use regression analysis to study whether VC-backed IPOs show different characteristics if they are backed by established or less-experienced venture capital firms. Capital under management of venture capitalists is used as proxy for reputation. The dependent variables are, as in the previous section, initial return and amount of 'money left on the table'. Regressions are performed on the following independent variables: 1) firm age; 2) time to exit; 3) underwriter ranking; 4) offer size; 5) number of financing rounds; 6) number of VC funds; 7) capital under management; 8) number of IPOs in the year of the IPO; 9) hot market periods; 10) length of lock-up period; and 11) VC's capital under management. Additionally, we introduce two variables with which we intend to analyse interaction effects. As we mentioned earlier, underpricing is a cost that companies bear when they go public because of the uncertainty of the company's true value. The younger the company, the greater is the underpricing. Therefore, we expect the coefficients to be at least partly supportive for the grandstanding hypothesis.

5.2.1 The European IPO Market

Table 12 and Table 13 presents the results of regression analyses regarding the European VC-backed IPO market. Most important, we find that IPOs that are backed by less reputable VCs are significantly more underpriced than ones backed by more established venture capitalists. This finding is consistent with the academic wisdom.

In general, higher-quality underwriters tend to take higher-quality companies public. If this is the case, the relation between rank and initial return should be negative and significant since firms with high quality can be taken public less underpriced. In contrast, we document that underwriter rank positively related to the level of initial return but the relation is insignificant. Furthermore, RANK+SMALL is also positively related to underpricing, implying that among less established venture capital firms IPO underwriters with higher ranks result in higher level of underpricing. Moreover, we did not find any evidence that offer size is in relation to underpricing for less experienced VCs.

In sum, most of the results favour the grandstanding explanation, that is, the relation between reputation and capital underpricing is consistent with academic literature.

Table 12: Initial Return of the European VC Backed IPOs

Multivariate Tests

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day The dummy variable SMALL shows whether the IPO is backed by less experienced VCs (VCs with average capital under management less than €300 million = 1, otherwise = 0). LOGSIZE explanatory variable is the natural log of offer size in € million. Firm age is calculated as the time span between foundation and IPO date in years. EXITTIME captures the time between the first investment date and the IPO date in years. The dummy variable MARKET shows whether a given IPO has taken place in the time intervals either 2004-2007 or 2013-2015. Lock-up periods are calculated as units where one unit reflects 180 days. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. Standard deviations are presented in brackets.

	Dependent variable: Initial Return					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	6.51***	4.69*	1.45	0.07	0.87	2.45
	[2.103]	[2.387]	[3.513]	[4.157]	[3.260]	[3.143]
AGE	0.03	0.03	0.00	0.00	0.02	0.01
	[0.042]	[(0.042]	[0.041]	[0.041]	[0.041]	[0.041]
EXITTIME	0.19	0.20	0.40	0.44	0.52*	0.52*
	[0.305]	[0.304]	[0.300]	[0.307]	[0.312]	[0.309]
ROUNDS	-0.52	-0.74	-0.77	-0.83*	-0.88*	-0.99**
	[0.416]	[0.495]	[0.473]	[0.484]	[0.490]	[0.489]
RANK	-	4.21	1.72	1.50	3.89	-
		[2.808]	[3.023]	[3.058]	[2.962]	
FUNDS	-	0.30	0.11	0.16	0.15	0.26
		0.4897	0.7963	0.7105	(0.438	[0.431]
		[0.436]	[0.420]	[0.431]		
LOGSIZE	-	-	2.24***	2.18***	1.96**	-
			[0.787]	[0.798]	[0.808]	
SIZE+SMALL	-	-	-	-	-	0.01
						[0.006]
FUNDSIZE	-	-	-0.01**	-0.01**	-	-
			[0.003]	[0.003]		
SMALL	-	-	-	-	3.79**	-
					[1.761]	
LOCKUP	-	-	-3.05***	-2.87***	-2.49**	-2.29**
			[1.009]	[1.050]	[1.050]	[1.034]
NUMBERIPOS	-	-	-	0.63	0.02	0.02
				[1.854]	[0.017]	[0.017]
MARKET	-	-	-	0.01	0.84	0.70
				[0.017]	[1.887]	[1.868]
RANK+SMALL	-	-	-	-	-	10.09***
						[3.65]
R-squared	0.015	0.030	0.132	0.134	0.110	0.121
Adj. R-squared	-0.003	0.001	0.089	0.081	0.055	0.072
F-statistic	0.825	1.033	3.092	2.498	1.993	2.472
Prob. (F-statistic)	0.488	0.399	0.003	0.008	0.037	0.011

Table 13 presents regressions with the independent variable amount of 'money left on the table'. The regression specifications are identical to those in Tables 10. Most important,

'money left on the table' is positively related to size, but the coefficient associated to less experienced VC (SMALL) is not statistically significant. The interaction variables show the same characteristics as they do in the previous regressions. Surprisingly, the interaction variables increase the estimation power of the model, from nearly 0.25 to 0.57 and 0.58 in regressions (5) and (6), respectively.

Table 13: Amount of 'money left on the table' of the European VC Backed IPOs

Multivariate Tests

Amount of 'money left on the table' is calculated as the price difference between offer price and first-day closing price of the stock multiplied by the number of shares issued. The dummy variable SMALL shows whether the IPO is backed by less experienced VCs (VCs with average capital under management less than €300 million = 1, otherwise = 0). LOGSIZE explanatory variable is the natural log of offer size in € million. Firm age is calculated as the time span between foundation and IPO date in years. EXITTIME captures the time between the first investment date and the IPO date in years. The dummy variable MARKET shows whether a given IPO has taken place in the time intervals either 2004-2007 or 2013-2015. Lock-up periods are calculated as units where one unit reflects 180 days. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. Standard deviations are presented in brackets.

Dependent variable: Amount of 'money left on the table'						
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	10.44	-1.63	-42.76	-41.54	-8.40	-6.71
	0.1259	0.8284	0.0001	0.0011	0.2527	0.3389
	[6.788]	[7.504]	[10.564]	[12.468]	[7.315]	[6.991]
AGE	0.18	0.18	0.03	0.04	0.03	0.03
	[0.135]	[0.131]	[0.123]	[0.124]	[0.093]	[0.091]
EXITTIME	-0.14	-0.08	-0.08	-0.13	0.51	0.50
	[0.983]	[0.956]	[0.902]	[0.920]	[0.700]	[0.687]
ROUNDS	-0.43	-1.94	-2.03	-1.95	-1.70	-2.00*
	[1.344]	[1.55]	[1.421]	[1.450]	[1.101]	[1.088]
RANK	-	27.45***	3.11	4.	1.4	-
		[8.827]	[9.092]	[9.171]	[6.645]	
FUNDS	-	2.11	1.99	1.99	0.84	1.06
		[1.371]	[1.262]	[1.292]	[0.983]	[0.958]
LOGSIZE	-	-	14.05***	14.06***	13.83***	-
			[2.366]	[2.394]	[2.414]	
SIZE+SMALL	-	-	-	-	-	0.08***
						[0.019]
FUNDSIZE	-	-	0.00	0.00	-	-
			[0.009]	[0.010]		
SMALL	-	-	-	-	6.44	-
					[3.950]	
LOCKUP	-	-	-1.42	-2.01	-3.29	-3.13
			[3.034]	[3.148]	[2.357]	[0.176]
MARKET	-	-	-	-6.43	-1.97	-2.87
				[5.560]	[4.234]	[4.154]
NUMBERIPO	-	-	-	0.02	0.06*	0.06
				[0.052]	[0.039]	[0.038]
RANK+SMALL	-	-	-	-	-	22.33***
						[8.679]
R-squared	0.013	0.078	0.245	0.251	0.569	0.585
Adj. R-squared	-0.005	0.050	0.208	0.205	0.543	0.559
F-statistic	0.713	2.814	6.605	5.396	21.262	22.658
Prob. (F-statistic)	0.545	0.018	0.000	0.000	0.000	0.000

5.2.2 The US IPO Market

Table 14 presents the grandstanding regressions we conducted on the US market. Most important, the coefficient associated to less experienced VC (SMALL) is large in size and significance. Hence, we can state that less established VCs underprice IPOs more than seasoned ones. In contrast to Gompers (1996), we document that offer size does not reduce underpricing. However, for small VCs the size of this effect drops substantially. The discrepancy between Gomper's result and ours could be due to the lack of signalling power what underwrites might bring into IPO deals. The coefficient of the interaction variable RANK+SMALL is positive and significant according to our results, which implies that higher-quality underwriters do not seem to be able reduce uncertainty around VC-backed IPOs. The effect of maturity, which is represented by AGE, and EXITTIME, is negative and significant, which is similar to other papers' findings (Gompers, 1996; Lee and Wahal, 2004).

Table 14: Initial Return of the US VC Backed IPOs

Multivariate Tests

First-day returns are calculated as the percentage change in price from the offer price to the closing price of the stock at the end of the first trading day. The dummy variable SMALL shows whether the IPO is backed by less experienced VCs (VCs with average capital under management less than $400 million = 1, otherwise = 0). LOGSIZE explanatory variable is the natural log of offer size in $ millions. Firm age is calculated as the time span between foundation and IPO date in years. EXITTIME captures the time between the first investment date and the IPO date in years. The dummy variable MARKET shows whether a given IPO has taken place in the time intervals either 2004-2007 or 2013-2015. Lock-up periods are calculated as units where one unit reflects 180 days. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. Standard deviations are presented in brackets.

Dependent variable: Initial Return						
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	33.17***	-18.04*	71.28***	-22.50*	-51.88	-1.82
	[3.869]	[9.526]	[6.872]	[11.962]	[10.310]	[6.449]
AGE	-0.32**	-0.44***	-0.25*	-0.23*	-0.24*	-0.09
	[0.140]	[0.139]	[0.131]	[0.126]	[0.123]	[0.126]
EXITTIME	-1.09***	-1.14***	-0.67*	-0.20	-0.19	-0.13
	[0.418]	[0.410]	[0.382]	[0.376]	[0.367]	[0.379]
ROUNDS	1.19*	1.42**	-	0.96	0.86	0.71
	[0.645]	[0.630]		[0.591]	[0.576]	[0.595]
RANK	-	1.46***	1.47***	1.04**	1.01**	-
		[0.449]	[0.394]	[0.410]	[0.399]	
FUNDS	-	-	1.04***	-	0.81**	0.86**
			[0.359]		[0.347]	[0.357]
LOGSIZE	-	9.44***	-	9.23***	9.17***	-
		[2.111]		[1.909]	[1.858]	
SIZE+SMALL	-	-	-	-	-	0.03
						[0.019]
FUNDSIZE	-	-	-0.05***	-0.04***	-	-
			[0.008]	[0.008]		
SMALL	-	-	-	-	36.45***	-
					[3.973]	
LOCKUP	-	-	-24.50***	-7.75**	-7.06**	-7.75**
			[3.287]	[3.470]	[3.383]	[3.470]
MARKET	-	-	-	-13.60***	-12.24***	-13.60***
				[2.924]	[2.858]	[2.924]
NUMBERIPO	-	-	-	0.25***	0.25***	0.24***
				[0.025]	[0.024]]	[0.025]
RANK+SMALL	-	-	-	-	-	3.52***
						[0.552]
R-squared	0.020	0.061	0.153	0.258	0.293	0.244
Adj. R-squared	0.017	0.056	0.147	0.250	0.286	0.237
F-statistic	6.505	12.408	28.452	32.786	39.210	33.934
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000

Table 15 shows the same regressions what we conducted in the previous table but now we plug our second dependent variable into the equation. Regression specifications indicate that the relations are really similar to the ones from the other setup. Most important, we find negative relation between underwriter rank and amount of 'money left on the table', however, the relation is insignificant. However, for small VCs the coefficient is significant which supports the grandstanding hypothesis.

Table 15: Amount of 'money left on the table' of the US VC Backed IPOs

Multivariate Tests

Amount of 'money left on the table' is calculated as the price difference between offer price and first-day closing price of the stock multiplied by the number of shares issued. The dummy variable SMALL shows whether the IPO is backed by less experienced VCs (VCs with average capital under management less than USD 400m = 1, otherwise = 0). LOGSIZE explanatory variable is the natural log of offer size in $ millions. Firm age is calculated as the time span between foundation and IPO date in years. EXITTIME captures the time between the first investment date and the IPO date in years. The dummy variable MARKET shows whether a given IPO has taken place in the time intervals either 2004-2007 or 2013-2015. Lock-up periods are calculated as units where one unit reflects 180 days. Statistical significance is represented by * at 10%, ** at 5% and *** at 1%. Standard deviations are presented in brackets.

Dependent variable: Amount of 'money left on the table'						
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	45.70***	-259.91	97.94***	-269.84***	-309.07***	10.40
	[9.560]	[21.541]	[17.460]	[28.950]	[25.352]	[15.823]
AGE	-0.47	-1.28***	-0.42	-0.94***	-0.96***	-0.13
	[0.347]	[0.314]	[0.332]	[0.305]	[0.302]	[0.308]
EXITTIME	-1.05	-1.55*	-0.23	-0.22	-0.22	-0.43
	[1.032]	[0.921]	[0.971]	[0.910]	[0.902]	[0.930]
ROUNDS	2.30	4.04***	-	3.13**	2.99**	1.37
	[1.593]	[1.425]		[1.430]	[1.418]	[1.459]
RANK	-	0.16	4.99***	-0.54	-0.59	-
		[1.015]	[1.002]	[0.992]	[0.982]	
FUNDS	-	-	1.47	-	1.75**	1.80**
			[0.913]		[0.853]	[0.877]
LOGSIZE	-	67.24***	-	67.29***	67.14***	-
		[4.774]		[4.619]	[4.569]	
SIZE+SMALL	-	-	-	-	-	0.62***
						[0.046]
FUNDSIZE	-	-	-0.09***	-0.06***	-	-
			[0.020]	[0.018]		
SMALL	-	-	-	-	51.19***	-
					[9.769]	
LOCKUP	-	-	-40.17***	-15.59*	-14.65*	-25.16***
			[8.352]	[8.397]	[8.320]	[8.498]
MARKET	-	-	-	-14.93**	-13.00*	-18.57**
				[7.076]	[7.028]	[7.241]
NUMBERIPO	-	-	-	0.36***	0.352***	0.28***
				[0.060]	[0.060]	[0.061]
RANK+SMALL	-	-	-	-	-	-2.59*
						[1.355]
R-squared	0.007	0.212	0.092	0.278	0.092	0.244
Adj. R-squared	0.003	0.208	0.086	0.270	0.086	0.237
F-statistic	2.0811	51.094	15.916	36.363	15.916	33.965
Prob(F-statistic)	0.101	0.000	0.000	0.000	0.000	0.000

6 Conclusion

In this paper we examine the short-term impact of venture capital backing in initial public offerings between 2000 and 2015. Our sample of VC-backed deals from 2000-2015 were matched to a control sample of non VC-backed listings by industry and offering size. We provided support against the certification role of venture capitalists, that is, venture backing does not certify the true value of the IPO firm. Explanations can be that the majority of IPO investors may see venture capital industry as a shadow-like, blurry asset class, or that venture capital investments are generally associated with high level of risk. Our results are consistent with the idea that venture capital firms with less reputation undertake actions, such as taking companies public that needs higher underpricing to have a successful IPO, in order to signal their quality, thus, successfully raising capital for subsequent funds.

Our study has made a significant contribution to existing literature because it examines both the European and the US IPO markets. Moreover, in spite of the large number of academic studies related to underpricing and venture capital, the literature seems to have a gap in research over recent years, which is being filled by our study.

The findings of our study has several implications for investors and other IPO market participants as well. First, retail and institutional investors might gain a deeper insight into the characteristics of the IPO market and the behaviour of issuers, more specifically on venture-backed listings. Second, management of issuing firms might obtain a better understanding of the financial aspects of an IPO as an exit route and a better understanding of the decision drivers of VCs.

Finally, future research should examine the private equity-backed IPOs in detail and make comparisons to venture capital-backed IPOs in order to detect any differences or similarities regarding post-IPO short-term stock performance. Furthermore, it could also be interesting to extend the sample by including other regions where the venture capital industry plays a significant role, such as Asia and Australia.

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8 Appendix

Figure 10: Graph of Number of IPOs and Average Initial Return in the US, 2000-2015

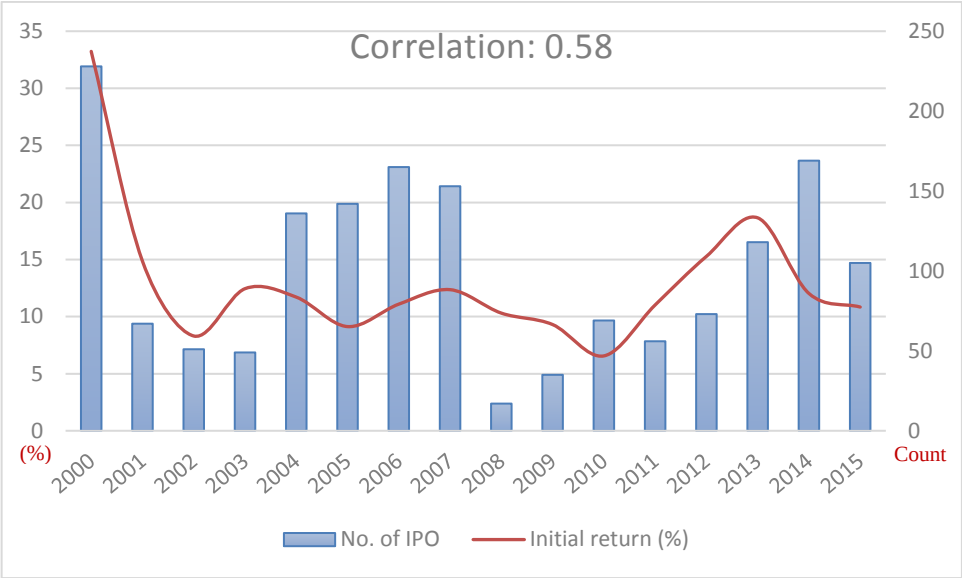

Figure 11: Graph of Average Amount of 'Money Left on the Table' and Average Initial Return in the US, 2000-2015

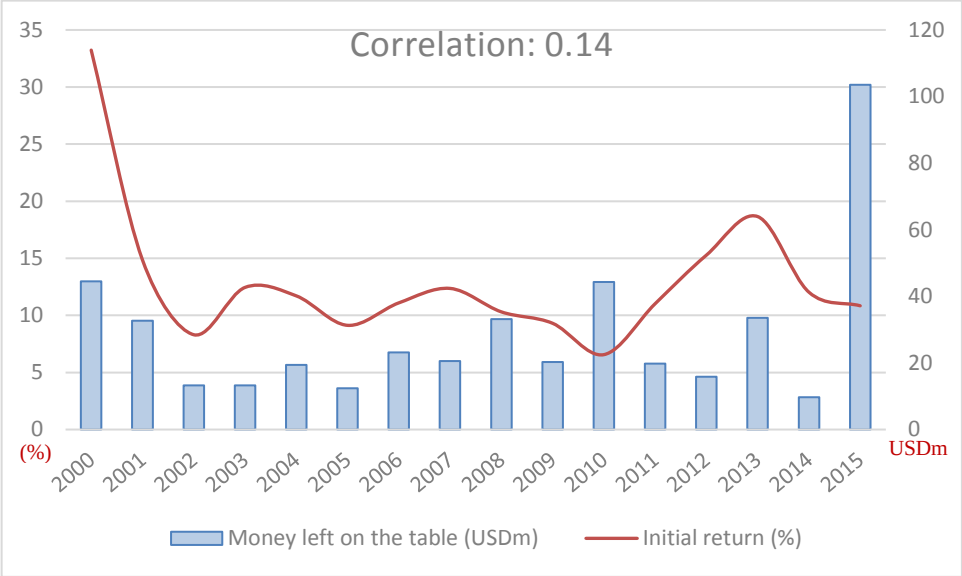

Figure 12: Graph of Number of IPOs and Average Initial Return in Europe, 2000-2015

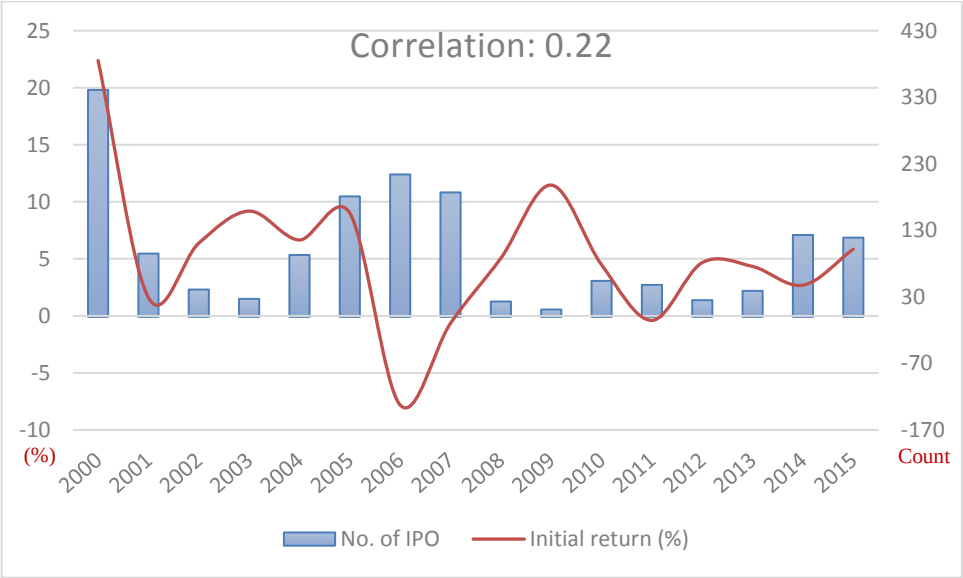

Figure 13: Graph of Average Amount of 'Money Left on the Table' and Average Initial Return in Europe, 2000-2015